MICOM, Inc.

OPERATING and SERVICE MANUAL

model 9100/9100A

FM MODULATOR

SERIALS PREFIXED

117---

MICOM, INC. 855 COMMERCIAL STREET, PALO ALTO, CALIFORNIA, U.S.A. 94303

MICOM INC

M1 METROLOGY

CERTIFICATION

MICOM, Inc., certifies that this instrument was thoroughly tested and inspected and found to meet its published specifications when shipped from the factory. MICOM also certifies that its calibration measurements are traceable to the U. S. National Bureau of Standards to the extent allowed by the Bureau's calibration facility.

WARRANTY

All our products are warranted against defects in materials and workmanship for one year from the date of shipment. Our obligation is limited to repairing products that prove to be defective during the warranty period. We are not liable for consequential damages.

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855 Commercial Street Palo Alto, California, U.S.A.

METROLOGY DEPT.

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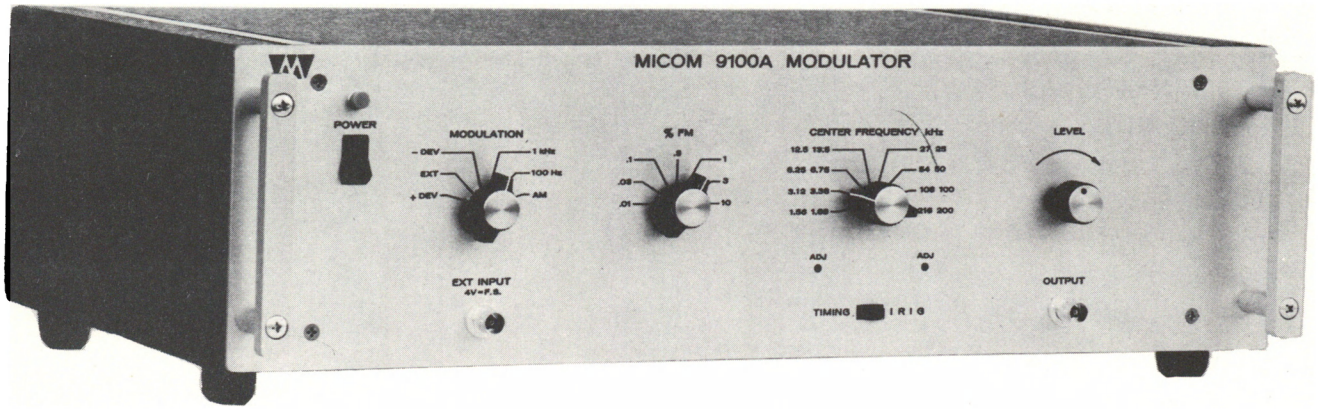


FIGURE 1-1

MODEL 9100/9100A FM MODULATOR

CENTER FREQUENCIES:

216, 108, 54, 27, 13.5, 6.75, 3.375, and 1.688kHz
200, 100, 50, 25, 12.5, 6.25, 3.125, and 1.562kHz

DEVIATION:

±40% maximum with <0.5% static linearity
±10% with <0.2% static linearity
<0.5% distortion to 20kHz modulation frequencies

BANDWIDTH:

Not restricted; less than .05 dB down to 20kHz

CENTER FREQUENCY DRIFT:

< ±0.1% 20°C to 40°C after ten-minute warmup

FM NOISE WITH ZERO MODULATION:

<5 ppm rms

OUTPUT LEVEL:

Adjustable to 2V rms square wave

OUTPUT IMPEDANCE:

600 ohms, single ended

MODULATION VOLTAGE:

4V peak-to-peak for 10% peak-to-peak deviation

INPUT IMPEDANCE:

1 kilohm ±2%, single ended

INTERNAL MODULATION:

1kHz ±5%, 4V peak-to-peak, ±1%
100Hz ±5%, 4V peak-to-peak, ±1%
DC + or - 4V ±1%

PRECISION ATTENUATOR:

Provides 10%, 3%, 1%, 0.3%, 0.1%, .03%, and .01% deviation ±1% with 4V peak-to-peak external modulation input.

OPTIONS:

9100A option includes AM modulator providing up to 30% modulation with less than .005% residual FM at modulation rates to 20kHz.

On special order, other center frequencies may be provided, as well as precision attenuators with different steps of modulation, such as 40%, 30%, 20%, 10%, etc.

GENERAL:

Power: 115 or 230V, ±10%; 50/60Hz; 25 watts
Front Panel Dimensions: 5.25" x 19" wide
Cabinet Dimensions: 6.25" x 19" x 13" overall
Ambient Temperature Range: 0 to 60°C
Bench or Rack Mount
Net Weight: 15 lbs. Shipping Weight: 20 lbs.

TABLE 1-1

MODEL 9100/9100A FM MODULATOR SPECIFICATIONS

SECTION I

GENERAL INFORMATION

1-1 DESCRIPTION

1-1.1 The MICOM Model 9100/9100A FM Modulator converts an input voltage to output frequency with high precision. It is particularly suited to wide-band modulation and, because of its very low noise level, to accurate generation of low modulation index signals. Modulating bandwidth exceeds 20 kHz with less than 1/2% error. Arbitrary modulating waveforms are readily handled with excellent fidelity.

1-1.2 Figure 1-1 shows the Model 9100/9100A Modulator. Table 1-1 is a list of the specifications.

1-1.3 The modulator operates at 216kHz center frequency, controlled by a front panel switch. Output frequencies of from 1.6875kHz to 216kHz or from 1.5625kHz to 200kHz are provided by a chain of binary dividers. The output is a square wave, adjustable to over 6V peak-to-peak, from a 600-ohm source.

1-1.4 A calibrated attenuator permits ±0.01% to ±10% peak deviation from internal precision dc sources or from a self-contained sine wave oscillator at 100Hz or 1kHz. Up to + or -40% modulation may be obtained with external inputs. Input impedance is 1 kilohm ±2%.

1-2 OPTIONS AVAILABLE

1-2.1 The Model 9100A includes an AM modulator with exceptionally low incidental FM. AM of 30% at up to 20kHz is provided by a 4V peak-to-peak external input.

1-2.2 On special order, other center frequencies may be provided, as well as precision attenuators with different steps of modulation, such as 40%, 30%, 20%, 10%, etc.

1-3 INSTRUMENT IDENTIFICATION

1-3.1 MICOM instruments are identified by a two-section, six-digit number. If the first three digits on the front of this manual do not agree with the serial number of your instrument, a change supplement to the manual will describe the differences between this manual and your instrument.

SECTION II
INSTALLATION

2-1 INSPECTION

2-1.1 This instrument was carefully inspected both mechanically and electrically before shipment. It should be physically free of mars or scratches and in perfect electrical order upon receipt. To confirm this, the instrument should be inspected for physical damage in transit. Also check for supplied accessories, and test the electrical performance of the instrument. If there is damage or deficiency, see the warranty inside the front cover of this manual.

2-2 CLAIM FOR DAMAGE IN SHIPMENT

2-2.1 Your instrument should be inspected and tested as soon as it is received. The instrument is insured for safe delivery. If the instrument is damaged in any way or fails to operate properly, file a claim with the carrier or, if insured separately, with the insurance company.

2-3 POWER REQUIREMENTS

2-3.1 The Models 9100 and 9100A will operate from either 115 or 230V ac, 50-60Hz. The instruments can be easily converted from 115 to 230V operation by changing the position of the slide switch, located on the rear panel, so that the designation appearing on the switch matches the nominal voltage of the power source. A 1/2 ampere, slow-blow fuse is used for 115V operation; a 1/4 ampere slow-blow fuse is used for 230V operation.

2-4 THREE-CONDUCTOR POWER CABLE

2-4.1 To protect operating personnel, the National Electrical Manufacturers' Association (NEMA) recommends that the instrument panel and cabinet be grounded. All MICOM instruments are equipped with a three-conductor power cable that, when plugged into an appropriate receptacle, grounds the instrument. The offset pin on the power cable three-prong connector is the ground wire.

2-4.2 To preserve the protection feature when operating the instrument from a two-contact outlet, use a three-prong adaptor to ground.

2-5 INSTALLATION

2-5.1 The 9100 and 9100A are fully transistorized; therefore, no special cooling is required. However, the instruments should not be operated where the ambient temperature exceeds 65°C (150°F).

2-6 RACK/BENCH INSTALLATION

2-6.1 The 9100 and 9100A are shipped as bench type instruments with rubber feet. To mount the instrument in a standard 19-inch relay rack, remove the side castings. Two 10-32 screws in each handle and one side mounting screw to the rear attach each casting to the instrument. Use the screws in the handles to fasten the instrument to a rack.

2-7 REPACKAGING FOR SHIPMENT

2-7.1 In repackaging for shipment, place the instrument in its original container if available. If the original container is not used, package the instrument as follows:

a. Wrap the instrument in heavy paper or plastic before placing it in an inner container.

b. Use plenty of packing material around all sides of the instrument and protect the panel faces with cardboard strips.

c. Place the instrument and inner container in a heavy carton or wooden box and seal with strong tape or metal bands.

d. Mark shipping container with "Delicate Instrument," "Fragile," etc.

If you have any questions, contact the factory.

NOTE

If the instrument is to be shipped to MICOM for service or repair, attach a tag to the instrument, identifying the owner and indicating the service or repair to be accomplished; include the model number and full serial number of the instrument. In any correspondence, identify the instrument by its model and serial numbers.

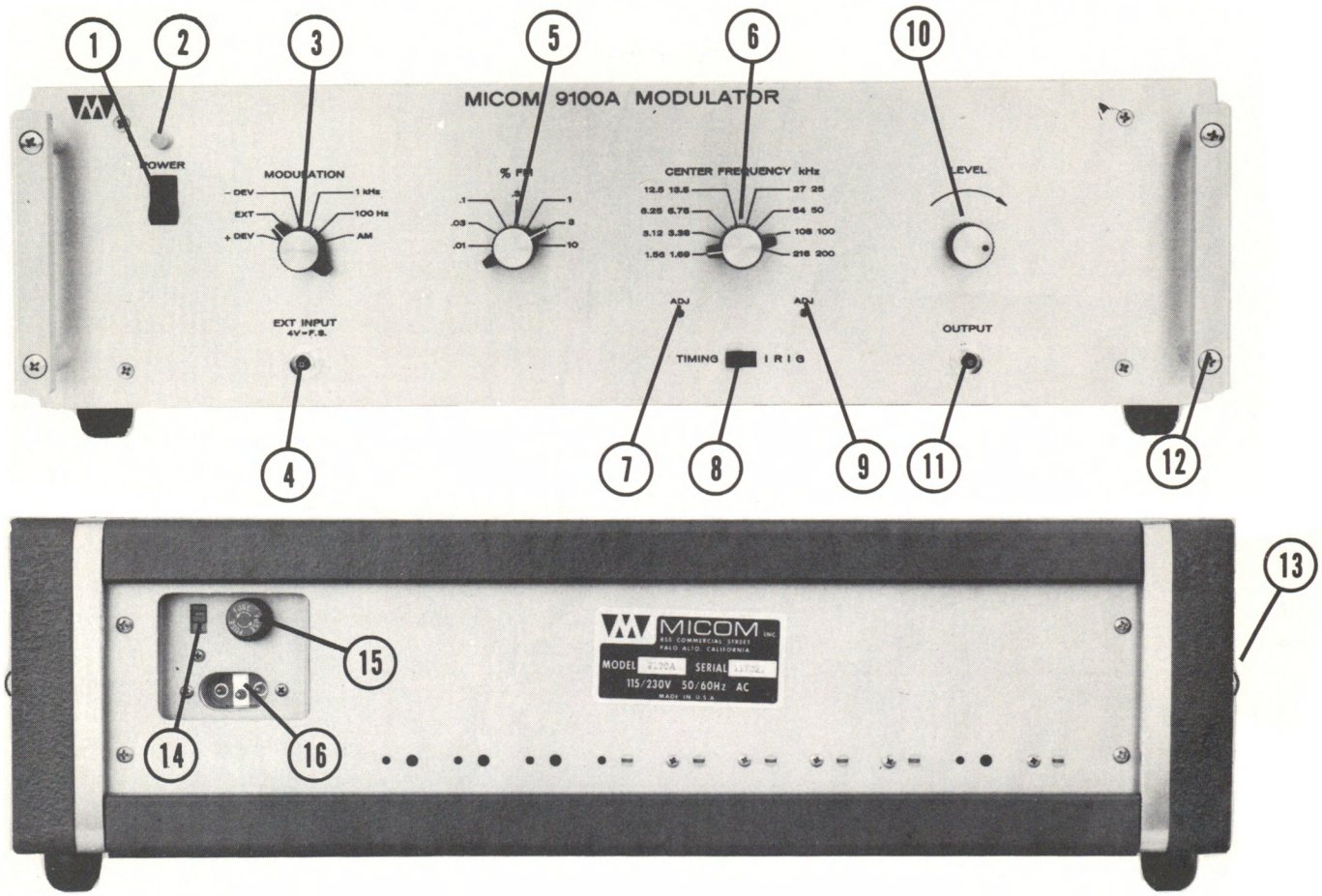


FIGURE 3-1

1. POWER rocker switch: Applies line power.
2. POWER indicator lamp: Indicates line power is on.
3. MODULATION selector switch: Selects the modulation mode: +DEV, EXT, -DEV, 1kHz internal, 100Hz internal, and (in 9100A only) AM.
4. EXT INPUT: BNC input jack connects external modulation voltage. Allows monitoring of internal modulation.
5. % FM attenuator switch: Attenuates the modulation source.
6. CENTER FREQUENCY selector switch: Selects the center frequency of output in eight binary steps.
7. TIMING ADJ: Screwdriver adjustment for 200kHz family of frequencies.
8. TIMING-IRIG selector switch: Selects either timing track (200kHz) or IRIG information (216kHz) frequencies.
9. IRIG ADJ: Screwdriver adjustment for 216kHz family of frequencies.
10. LEVEL control: Uncalibrated output level control.
11. OUTPUT: BNC output connector. Output impedance is 600 ohms.
12. MOUNTING SCREWS: 10/32 screws mount instrument to standard rack or to side castings for bench use.
13. SIDE MOUNTING SCREWS: Attach side casting for bench use.
14. 115/230V SLIDE SWITCH: Selects 115 or 230V ac line operation.
15. FUSE: 1/4 ampere slow blow. Protects line and instrument circuits.
16. AC POWER CONNECTOR: Provides input connections for ac power.

SECTION III

OPERATING INSTRUCTIONS

3-1 INTRODUCTION

3-1.1 The Model 9100/9100A Precision FM Modulator includes internal calibrated sources of modulation. The Model 9100A also includes an AM modulator that produces very low residual FM.

3-1.2 This section explains the controls of the Model 9100/9100A and outlines the operating procedures for each mode of operation.

3-2 LOCATION OF CONTROLS AND INDICATORS

3-2.1 Figure 3-1 illustrates and describes the function of all front and rear panel controls, connectors, and indicators.

3-3 OPERATING INSTRUCTIONS

3-3.1 Make sure that the 115 to 230V slide switch on the rear panel matches the line voltage to be used, and connect power to the instrument.

3-3.2 Turn on ac POWER. POWER lamp will glow.

3-3.3 Select the operating frequency with the TIMING-IRIG switch and the CENTER FREQUENCY switch.

3-3.4 Adjust to the desired output level.

3-3.5 Select the desired modulation: + DEV, - DEV, 1kHz or 100Hz from calibrated internal sources, or EXT. External modulation voltages from dc to 20kHz may be accommodated, but the modulation frequency should be less than one half the center frequency selected.

3-3.6 Select the % MODULATION desired.

3-4 AM MODULATION (Model 9100A)

3-4.1 AM modulation of 30% by a 4 V peak-to-peak EXT INPUT signal is provided in the AM position of the MODULATION switch. Modulating frequencies to 20kHz can be accommodated.

WARNING

Do not connect a low impedance load to the EXT INPUT BNC jack when using internal modulation sources. The internal voltages are connected to the EXT INPUT jack to permit confirmation of their level with high impedance ($\geq$ 1 megohm) voltmeters.

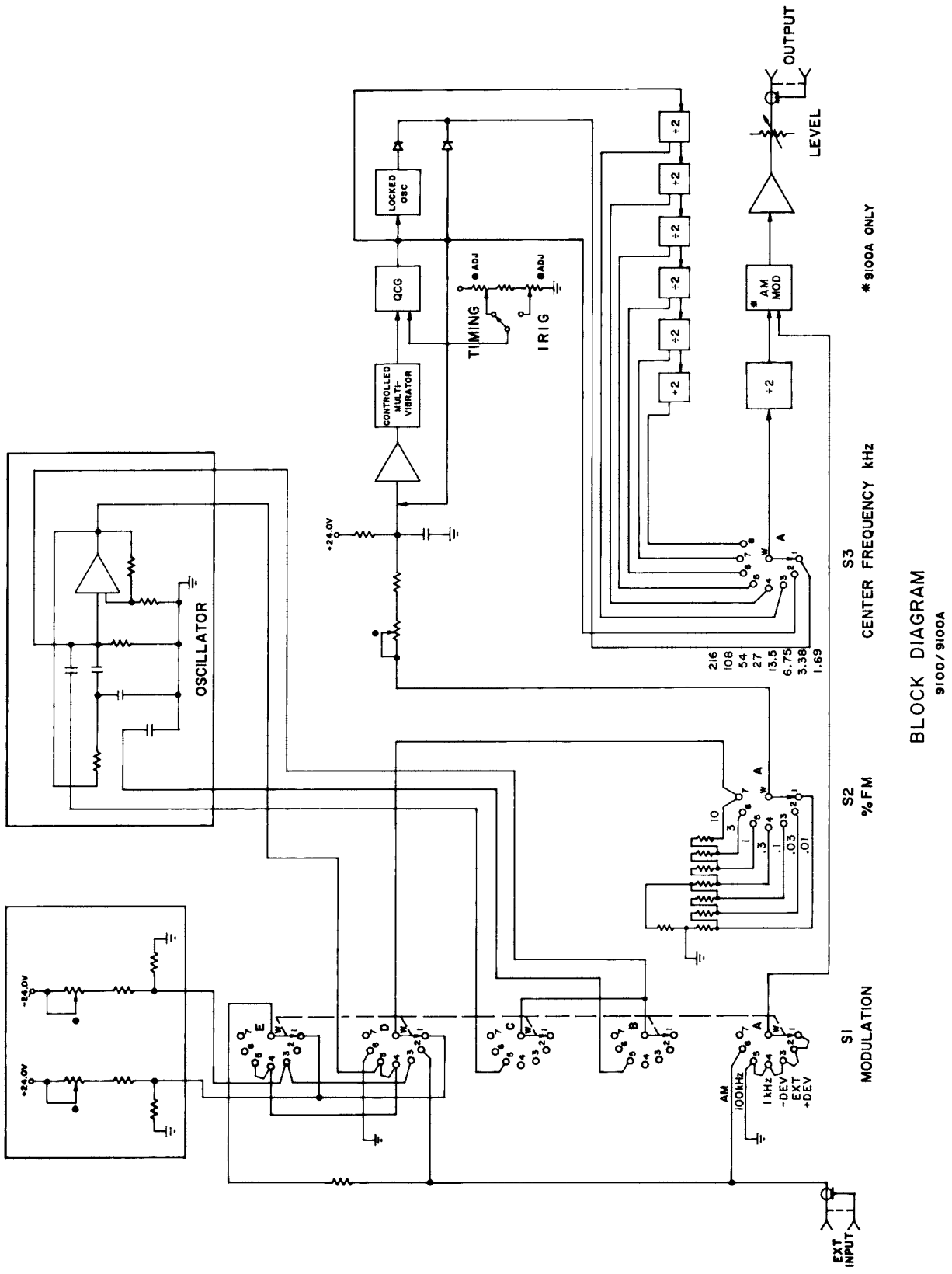


FIGURE 4-1

BLOCK DIAGRAM

SECTION IV

THEORY OF OPERATION

4-1 GENERAL

4-1.1 The Model 9100 is a solid-state precision FM modulator. The basic center frequency is 200 kHz or 216 kHz; lower frequencies are provided through a chain of binary dividers. A buffer amplifier provides a square-wave output of up to 6V peak-to-peak through a 600-ohm bridged-T variable attenuator. The Model 9100A also has a precision AM modulation provision.

4-2 BLOCK DIAGRAM DESCRIPTION

4-2.1 Figure 4-1 shows a simplified block diagram of the Model 9100/9100A FM Modulator.

4-2.2 The FM modulator is based on a process where an input current is matched by an average negative current accurately proportional to the output frequency in a feedback system which requires that the sum be zero. Modulating the input current causes a proportional modulation of the output frequency. A quantum charge generator (QCG) delivers a precisely controlled quantum of charge to the input at each cycle of the output. Since $I = Qf$, the feedback current is proportional to frequency. A positive 1mA is the input when there is no external modulation; the quanta delivered each cycle is controlled by the TIMING-IRIG switch to set the center frequency at 200kHz or 216kHz as required.

4-2.3 A phase-locked square wave oscillator and a chain of binary dividers allows any output frequency from 2^0 to 2^{-7} times the modulator frequency to be selected.

4-2.4 Precise + and - dc sources and a sine wave oscillator with tight amplitude control, operating at 1kHz or 100Hz, permit internal modulation. External signals may also be used to modulate the output.

4-2.5 A precision attenuator allows accurate deviation of the center frequency of ±0.01% to ±10% in seven steps from any modulating source.

4-2.6 A buffer amplifier and 600-ohm attenuator provide an output level adjustable up to 6V peak-to-peak.

4-3 AM MODULATOR OPTION (Model 9100A)

4-3.1 Precision AM modulation up to 30% at rates of up to 20kHz is provided for by means of a balanced, symmetrical modulation of the square wave input to the buffer amplifier by an external modulation voltage.

4-4 SCHEMATIC DESCRIPTION

4-4.1 FM MODULATOR (Card 9131, Schematic 6-1)

Operation of the modulator can be understood by tracing the signal flow through the circuitry. A constant 1mA current from the +24V supply through R5 and R6 flows into the emitter of Q2 and charges C2 towards ground. When the voltage at the base of Q4 causes Q5 to conduct, Q6 is turned off. When Q6 turns off, Q7 also turns off, allowing the controlled multivibrator (Q9 and Q10) to oscillate and trigger a one-shot. Each time the controlled multivibrator fires, the one-shot (Q11 and Q12) goes through one cycle of operation. During the period of the one-shot, Q13 is turned off, thereby turning off switch Q15 and allowing a constant current to flow through Q14. This current causes the charge previously stored in the QCG capacitor (C13, C14, and C15) to flow through the emitter of Q1 to charge C3 in a negative direction, thereby causing Q6 to conduct and Q7 to clamp the controlled multivibrator off. This sequence produces one cycle of output, which is coupled to following circuitry through C10. At the end of the one-shot period, the QCG capacitors are recharged by Q15 through R36 and CR1. As the input current continues to flow through Q2, C3 again charges in the positive direction, causing the sequence to repeat at a rate proportional to the input current. It is obvious that, except for a small constant, the average input current must be matched by the current $\Delta E \times C_{QCG} \times f$. ΔE is controlled through Q8, CR4, and R21 by either R1 or R2 on the front panel, screwdriver zero adjustments, through TIMING-IRIG switch (S4) to make the center frequency 200 kHz or 216kHz respectively.

The input voltage is temperature compensated by means of Q3 and adjusted to zero ±2mV with R11. CR6, CR7, and CR8 compensate for the thermal variations of Q1 and CR1. CR2 and CR3 compensate for the thermal variations of Q8 and CR4, which are effective in the 200kHz position.

Modulation is applied through 40 kilohms (R1 + R2) into the dynamic impedance of Q1 of about 30 ohms. R1 is adjusted to provide 10% deviation with a 4.00V input. The precision % FM attenuator (S2) is calibrated to provide a 1 kilohm ±2% input impedance and to provide ratios from 0.1% to 100% in seven steps. L1 (C17) and R37 (C18) isolate the modulator from the rest of the instrument. R30 (C11) and R23 (C8) contribute to high frequency stability.

4-4.2 LOCKED OSCILLATOR AND DIVIDER CHAIN (Card 9133, Schematic 6-2)

Input triggers from the FM modulator are differentiated through C1 and R2 to switch Q1 at each cycle of the modulator. The negative going output pulses of Q1 are coupled through R3 and C3 to trigger the binary divider chain; through C4 to R24 and R25 to serve as a 216kHz output; and through C5 to lock the symmetrical emitter-coupled multivibrator (Q2 and Q6). The out-of-phase output of the multivibrator is coupled through Q7, differentiated through C7 and R21, and mixed through CR2 to provide a 432kHz trigger output at R21 for 216kHz operation. The symmetrical multivibrator operates with equal currents provided by constant current sources (Q3 and Q5). Due to symmetry of base drives and emitter currents of Q2 and Q6, the locked multi-

vibrator provides symmetrical outputs at any frequency higher than its natural frequency. It is phase-locked to the input by turn-off triggers applied through CR1 to the base of Q2.

FF1 through FF3 are dual J-K integrated circuit flip-flops connected as a chain-of-six binary divider. Deck B of the CENTER FREQUENCY switch (S3) inhibits all unused stages of the divider to prevent subharmonic modulation of the test frequency due to interaction of the dual dividers. R1 (C2) and R4 (C6) isolate the stage from the rest of the instrument, and R22 (C8) provides the proper operating voltage to the integrated circuits.

4-4.3 INTERNAL SINEWAVE OSCILLATOR (Card 9132, Schematic 6-3)

Q1 and Q3 comprise a conventional Wien bridge sinewave oscillator. Positive feedback from the collector of Q3 through R1 (C1) and R2 (C7) to the input of Q1 is combined with negative feedback through R11 to produce stable oscillations at 1kHz. The amplitude is controlled by the use of a peak comparator (Q4 and Q5), the output of which is filtered and amplified by Q2 to control the resistance of DS1. As the output level increases, Q4 conducts over a longer fraction of each cycle, causing Q2 to increase the current through DS1. A larger current through DS1 causes its resistance to increase, thereby increasing the negative feedback, hance reducing the output amplitude. In the 100Hz position of the MODULATION select switch (S1), C1 and C3 are connected in parallel with C5 and C7 to lower the frequency oscillation to 100Hz. C2 and C6 are selected to trim the frequency to 1kHz ±5%, and C2 and C4 are selected to trim the frequency to 100Hz ±5% and also to provide the same output level as obtained at 1kHz. R5 and R12 are selected as needed to increase amplitude stability. The threshold of the peak comparator is set by R19, a screwdriver pot, to set the output amplitude.

4-4.4 OUTPUT AMPLIFIER (Card 9136, Schematic 6-4)

Carrier signals from the divider chain on Card 9133, selected by the CENTER FREQUENCY switch (S3), trigger FF1, an integrated circuit flip-flop, to obtain a square wave at the selected carrier frequency. The flip-flop output drives the base of Q1; and from the collector of Q1, the signal passes through Q2 and Q3 (complementary emitter-followers) to the output level control. The output level is controlled by a 600-ohm bridged-T attenuator between the amplifier and the OUTPUT BNC connector. Current flow through R5 provides negative feedback. C1, C3, C4, and C6 isolate the circuit from the rest of the instrument.

4-4.5 AM MODULATOR -- 9100A ONLY (Cards 9134 and 9135, Schematics 6-4 and 6-5)

In the AM position of the MODULATION switch (S1), an external modulating signal from EXT INPUT (J7) goes to a phase-splitter (Q1 on Card 9134) through R1, a 15-screwdriver control that adjusts the percent modulation. The phase-splitter produces two equal and oppositely phased outputs. The signal at the collector of Q1 is fed to a phase-shifting network consisting of phase-splitter (Q2, R15, and C4). The signal at the junction of C4 and R15 has the same amplitude as at the collector of Q1, but has increasing phase shift with increasing frequency. This signal then goes to an emitter-follower (Q1 on Card 9135), which provides the reference level for clamping Diode CR1 on Card 9135.

The modulating signal on the emitter of Q1 on Card 9134 is also fed to a phase-shifting network consisting of phase-splitter (Q3, R20, and C7). Again, the signal is unchanged in amplitude but is given an increasing phase-shift with increasing frequency. This signal passes through emitter-follower Q2 on Card 9135 and sets the reference level for clamping Diode CR2 on Card 9135.

Carrier signals selected by the CENTER FREQUENCY switch (S3) trigger integrated circuit flip-flop FF1 on Card 9135 to obtain a square wave driving signal for transistor switch Q3 at the selected carrier frequency. The carrier amplitude is controlled by CR1 on positive half cycles and by CR2 on negative half cycles. Since the clamping levels of these diodes are controlled by the modulating signal from the EXT INPUT BNC jack (J7), amplitude modulation is obtained with CR1 determining the envelope of the positive half cycles of the carrier, and CR2 determining the envelope of the negative half cycles.

The relative amplitudes of the positive and negative envelopes are made the same by adjusting ENVELOPE BALANCE (R6) on Card 9134. Any relative phase shift between the two envelopes at higher modulation frequencies is corrected by adjusting PHASE BALANCE (C7) on Card 9134. The modulated carrier is coupled to the output amplifier through emitter-follower Q4 (Card 9135).

4-4.6 OUTPUT AMPLIFIER (Card 9136A, Schematic 6-6)

The modulator output is coupled to Q1, a common emitter amplifier, through R2, C2, and R3. The output of Q1 drives Q2 and Q3, complementary emitter-followers that are coupled to the OUTPUT jack (J8) through the output LEVEL control, a 600-ohm bridged-T attenuator. C1 and C3 isolate the amplifier from the rest of the instrument; negative feedback is provided by R4.

4-4.7 REGULATED POWER SUPPLY MODULE (Card 8230, Schematic 6-7)

The regulated power supply is constructed as a self-contained module. The input transformer is designed for 48 to 64Hz operation at 115 or 230V ±10%. S10 must be switched to the appropriate position for the line voltage used. The supply is designed to provide + and -24V at up to 500mA. Noise and 120Hz ripple is less than 200μV, and variations in output will be less than 1/2% over the 60°C ambient range of operation or the ±10% range of line level.

Operation of the regulator will be understood by reference to Schematic 6-7. The output voltages of the shielded power transformer are full-wave rectified by CR1 and CR2 to provide + filtered dc across C5, and rectified by CR3 and CR4 to provide - filtered dc across C6. C1, C2, C3, and C4 suppress high-frequency transients from the power line. The positive output voltage is set by Q1, a germanium power transistor, under the control of Q8, a voltage amplifier. Q8 amplifies the output of Q4, an error amplifier, which amplifies the difference between the breakdown voltage of CR7 and the fraction of the output voltage developed across R11 by R9 and R10 in series. The breakdown voltage of CR7 was chosen to compensate the -2mV/°C variation in base-to-emitter voltage of Q5. R9 is adjusted to provide 24.00 ±0.02V output. C8 and R7 contribute to the high-frequency stability, C14 reduces the 120Hz supply ripple, and C11 provides a low dynamic impedance output at high frequencies. The

negative regulator uses the +24V output as its reference. The voltage from the precision divider (R24 and R28), connected across the +24V and -24V outputs, is compared with a fraction of the -24V from the divider, R6 in parallel with R13, and R12 by a differential pair, Q6 and Q7. The error voltage is amplified by Q5 and applied to Q2, a germanium power transistor, in the sense which reduces the error. R6 is selected to make the output voltage -24.00V ±100mV. Q3 is used as a constant-current load for the collector of Q5 to maintain a very high voltage gain for the error amplifier. C9 and R14 contribute to the high-frequency stability of the circuit, and C10 provides a low output impedance at high frequencies.

METROLOGY DEPT.

SECTION V
MAINTENANCE AND CALIBRATION

5-1 INTRODUCTION

5-1.1 This section provides maintenance and service information for the Model 9100/9100A FM Modulators. These are precision instruments designed to provide long, trouble-free service without requiring maintenance or adjustments. To check the calibration of the instrument to full accuracy will require instruments not normally available except in the largest laboratories. If trouble is experienced with an instrument, it is recommended that the instrument be returned for prompt repair or recalibration to:

MICOM, Incorporated
855 Commercial Street
Palo Alto, California 94303
Telephone (415) 328-2961

5-2 TEST EQUIPMENT

5-2.1 Recommended test equipment for performance checking and troubleshooting is listed in Table 5-1. Other instruments may be used if their specifications or performance equals or exceeds the required characteristics.

5-3 INSTRUMENT COVER REMOVAL

5-3.1 Unscrew and remove the six countersunk phillips-head screws holding each cover on. Covers may then be lifted off. When replacing covers, make sure the top cover (which has a cork strip inside) is put back on the top.

5-4 TROUBLESHOOTING AND REPAIR

5-4.1 SUBSTITUTION: Troubleshooting is greatly simplified if checking is done by replacing a suspected plug-in circuit card with one known to be operating properly. When a malfunctioning card is found, trouble may be traced to the offending component or the card returned to MICOM for repair.

5-4.2 TROUBLESHOOTING OF CIRCUIT CARDS: Refer to Section IV, Principles of Operation, for details on the operation of all assemblies used in the Model 9100/9100A. Reference to the schematic for each circuit card will show key waveforms and operating dc levels to help isolate faulty components. For easy access to operating plug-in cards, use the PC board extender included with the instrument, attached to the card cage behind the switch plate.

5-4.3 PRINTED CIRCUIT COMPONENT REPLACEMENT: To prevent damage to the circuit board, apply heat sparingly and work carefully. A 37-1/2 Watt iron with a small, clean tip is recommended. The replacement procedure is as follows:

a. Remove defective component.

b. Melt solder in component lead holes and remove the excess solder with a clean, dry iron. Clear holes with a thin toothpick or a suction type solder removal tool, pushing from trace side of the card.

c. Bend leads of replacement component to fit and insert component leads in holes. Solder leads in place, using heat and solder sparingly.

d. If a pad or printed circuit trace is lifted, press conductor pad against the board and hold until solder cools so that the component lead holds pad firmly in place.

5-5 PERFORMANCE CHECKS AND CALIBRATION

5-5.1 POWER SUPPLY

a. Set line voltage to normal value: 115 or 230V ac.

b. The +24V supply rail (Pin 15 on any PC socket) should read 24.0 ±0.1V dc. If outside this range, adjust R9 (15-turn screwdriver pot) on power supply module.

INSTRUMENT TYPE	REQUIRED CHARACTERISTICS	RECOMMENDED INSTRUMENT
DC VT VOLTMETER BRIDGE	4mV to 30V, 0.1% Accuracy	ESI Model 300 Potentiometric Bridge
AC VT VOLTMETER	10mV to 10V, 0.2% Accuracy	Wavetek Model 204 AC Voltmeter
OSCILLOSCOPE	10mV to 10V/Division; DC to 15mHz Dual Channel	Tektronics Model 422
FREQUENCY COUNTER	100Hz to 500kHz, ±.001%	HP Model 3734A
FM DEMODULATOR	1.5625 to 216kHz Center Frequency, 20kHz BW, <.004% Peak-to-Peak Noise	MICOM Model 8300 Flutter Meter

TABLE 5-1

RECOMMENDED TEST EQUIPMENT

c. The -24V supply rail (Pin 1 on any PC socket) should read -24.0 ±0.1V dc. If outside this range, adjust R6 on power supply module.

d. Vary line voltage from 105 to 130V ac or from 210 to 260V ac. The +24 dc rail should not vary more than ±.05V dc.

5-5.2 VOLTAGE TO FREQUENCY CONVERTER (Card 9131)

a. Switch to 200kHz output, TIMING, 200kHz, EXT INPUT, output level approximately 3V peak-to-peak. Connect counter to output and measure frequency. Output frequency should be 200kHz ±100Hz; if outside this range, reset TIMING ADJ, front panel screwdriver pot. Switch to IRIG, 216kHz; output frequency should be 216kHz ±100Hz. Reset IRIG ADJ, front panel screwdriver control, if necessary.

b. Set CENTER FREQUENCY to 200kHz, MODULATION to + DEV, and % FM to 10%. Measure voltage between wiper and circuit common on the switch as +4.00V ±10mV; if necessary, adjust R3 on rear of MODULATION switch. Measure change in output frequency with counter as 20kHz ±100Hz; adjust R1, Card 9131, if necessary to bring within tolerance. Switch MODULATION switch to -DEV and measure voltage as above as -4.00V ±10mV; readjust R10 on rear of MODULATION switch if necessary. Measure change in output frequency from center as -20kHz ±100Hz. Check deviation at 216kHz IRIG CENTER FREQUENCY:

+10% should cause frequency to increase 21.6kHz ±108Hz

-10% should cause frequency to decrease 21.6kHz ±108Hz

If necessary, compromise adjustment of R1 for best linearity.

c. Check precision attenuator in + DEV position. Connect ESI Model 300 Potentiometric Bridge to wiper of Deck A % FM switch (S2) with ground terminal Pin 7, Deck B, of S2 as reference. In the 10% position, output = 4.00V ±1mV; 3% output = 1.20V ±10mV; 1% output = 0.40V ±4mV; 0.3% output = 120mV ±1mV; 0.1% output = 40mV ±0.4mV; .03% output = 12mV ±0.12mV; and .01% output = 4mV ±.04mV.

If the modulator does not perform as above, reference to the schematic, circuit description, and key waveforms will help disclose the source of trouble. If the modulation sensitivity is out of tolerance, remove the test jumper and measure the input offset current. This current should be 1.000 ±.05mA and must be checked if Q1 is changed. The voltage at the emitter of Q1 should be 0.00V ±3mV and must be reset by means of R39 if Q1 is changed. If any changes are made on Card 9131, the TIMING ADJ pot should be placed in a mid position and C15 adjusted to provide 200kHz ±200Hz output; then the TIMING ADJ should be moved to provide 200kHz ±100Hz, and the IRIG ADJ reset to provide 216 kHz ±100Hz.

5-5.3 100HZ, 1KHZ OSCILLATOR (Card 9132-1)

a. In the 1kHz MODULATION position, check the output level and frequency of the oscillator. Connect an AC VTVM Wavetek Model 204 (or equivalent) to the EXT INPUT BNC jack and measure amplitude as 1.414V rms ±1%. Switch the MODULATION switch to 100Hz and measure voltage as 1.414V rms ±1%. Adjust R9 (Card 9132) if necessary, for best compromise to provide 4V peak-to-peak (1.414V rms) at both frequencies.

5-5.4 OUTPUT AMPLIFIER (Card 9136)

Connect an oscilloscope to the output BNC jack and observe the output with an oscilloscope. The LEVEL control clockwise limit should produce a square wave output exceeding 6V peak-to-peak. Adjust the level to 1V peak-to-peak open circuit, then load output with a 600-ohm ±5% resistor. Output should reduce to 0.45 to 0.55V peak-to-peak.

5-5.5 AM MODULATION (Model 9100A ONLY)

a. Set MODULATION switch to AM, CENTER FREQUENCY to 108kHz. Apply 2kHz sine wave at a 4V peak-to-peak (1.414V rms) amplitude. Connect output BNC to both channels of a dual-channel oscilloscope (Tektronic Model 544 or equivalent). Externally synchronize the scope with the modulating voltage. Balance the gain of the oscilloscope amplifiers so the two displays can be superimposed exactly.

b. Invert the polarity on one oscilloscope channel and position the two displays to superimpose the positive and negative envelopes of the modulated wave. If necessary, adjust R6 on Card 9134 for exact match.

c. Change the modulating frequency to 20kHz and position display on an oscilloscope to superimpose both envelopes. If necessary, adjust C7 on Card 9134 for exact coincidence.

d. Check the modulation percentage using a trapezoidal pattern. Apply 9100 output to the Y axis of the oscilloscope and the modulating voltage to the X axis; center the display on the screen; and, by adjusting the vertical gain, make the left edge of the pattern eight divisions high. Vary modulating frequency until a straight line envelope is obtained. The right hand amplitude of the trapezoid should be 2.2 divisions in amplitude for 30% modulation. If necessary, adjust screwdriver control R1, Card 9134, to produce the correct pattern for 30% modulation.

5-5.6 FM NOISE CHECK

Apply the output of the Model 9100 Modulator operating at 216kHz to the input of the MICOM Model 8300 Flutter Meter. Adjust the output level to 3V peak-to-peak. Switch FLUTTER BANDWIDTH to 20kHz and % PEAK-TO-PEAK to .01%. With PK TIME at 1 σ, the flutter indicator should increase no more than .001% above the indication obtained when the flutter meter measures the output of a pure 216kHz oscillator.

SECTION VI

SCHEMATICS

6-1 SCHEMATIC DIAGRAMS

6-1.1 This section contains the schematic diagrams necessary for maintenance and calibration of the MICOM Model 9100/9100A FM Modulators. Each diagram illustrates the circuits on each plug-in card and all associated switches, switch assemblies, connectors, and related components.

6-1.2 The following conventions are used on all drawings:

1. Components mounted on the card are enclosed within a dotted outline.

2. Front panel designations are enclosed within a box:

   TEST FREQUENCY

3. Component values marked ▲ are nominal, optimum values selected at the factory, or may be omitted.

6-1.3 Figure 6-1 on Page 6-2 shows the location of all cards, connectors, and controls in the package.

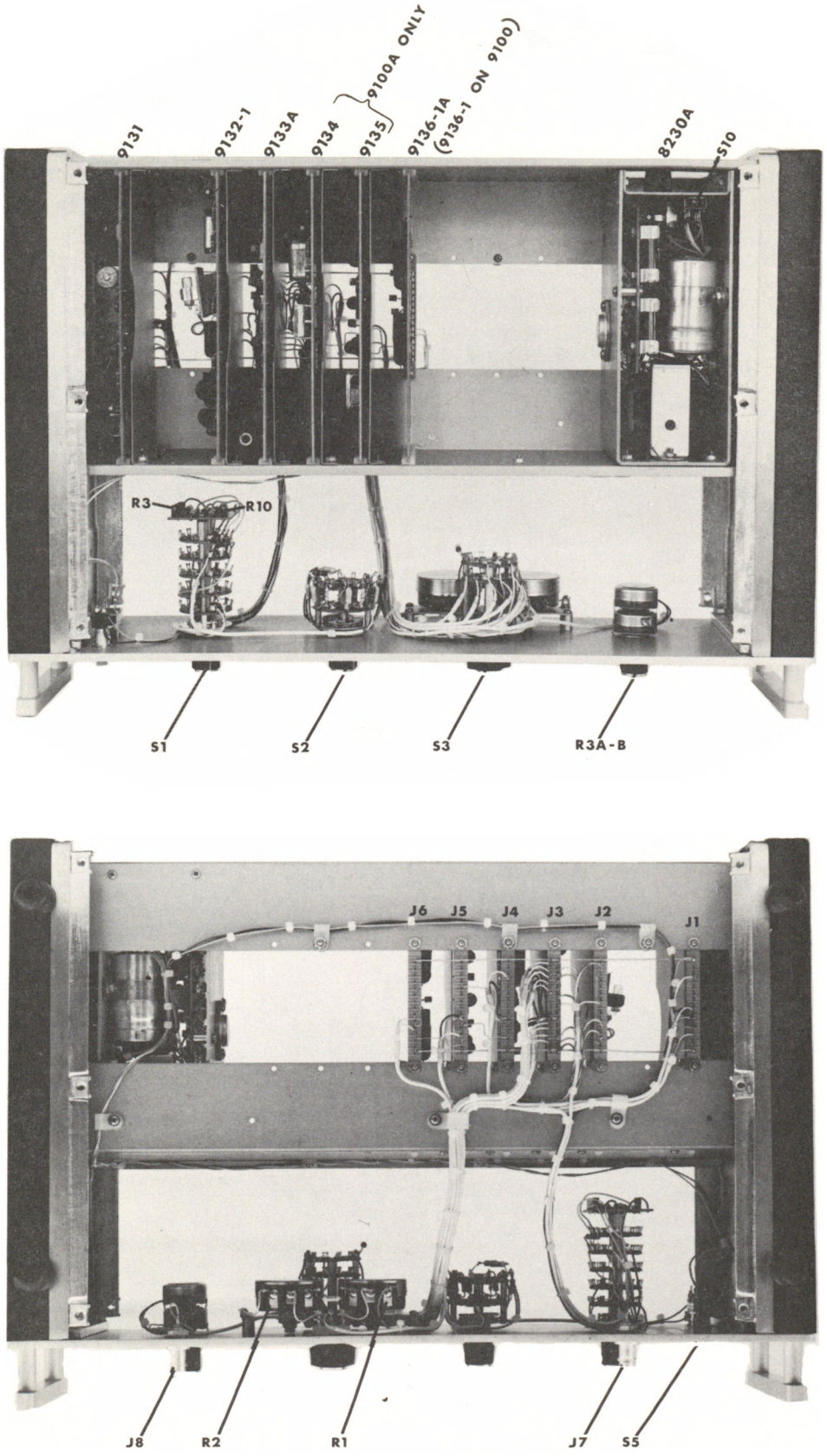
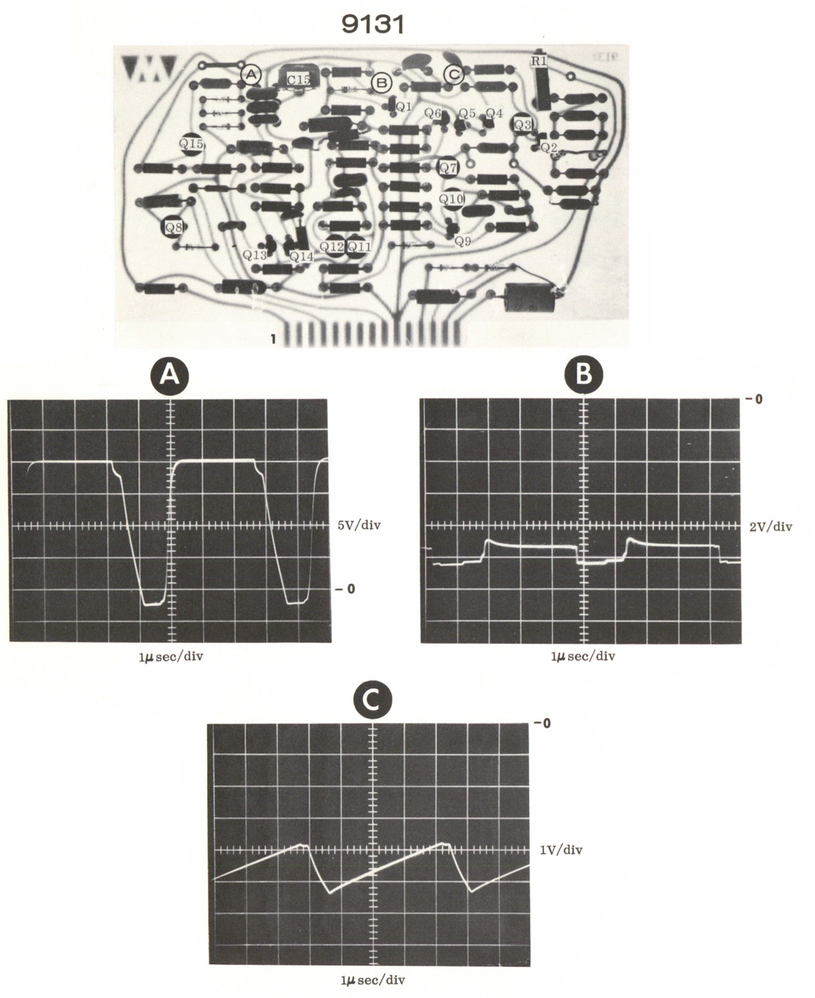


FIGURE 6-1

COMPONENT LOCATION



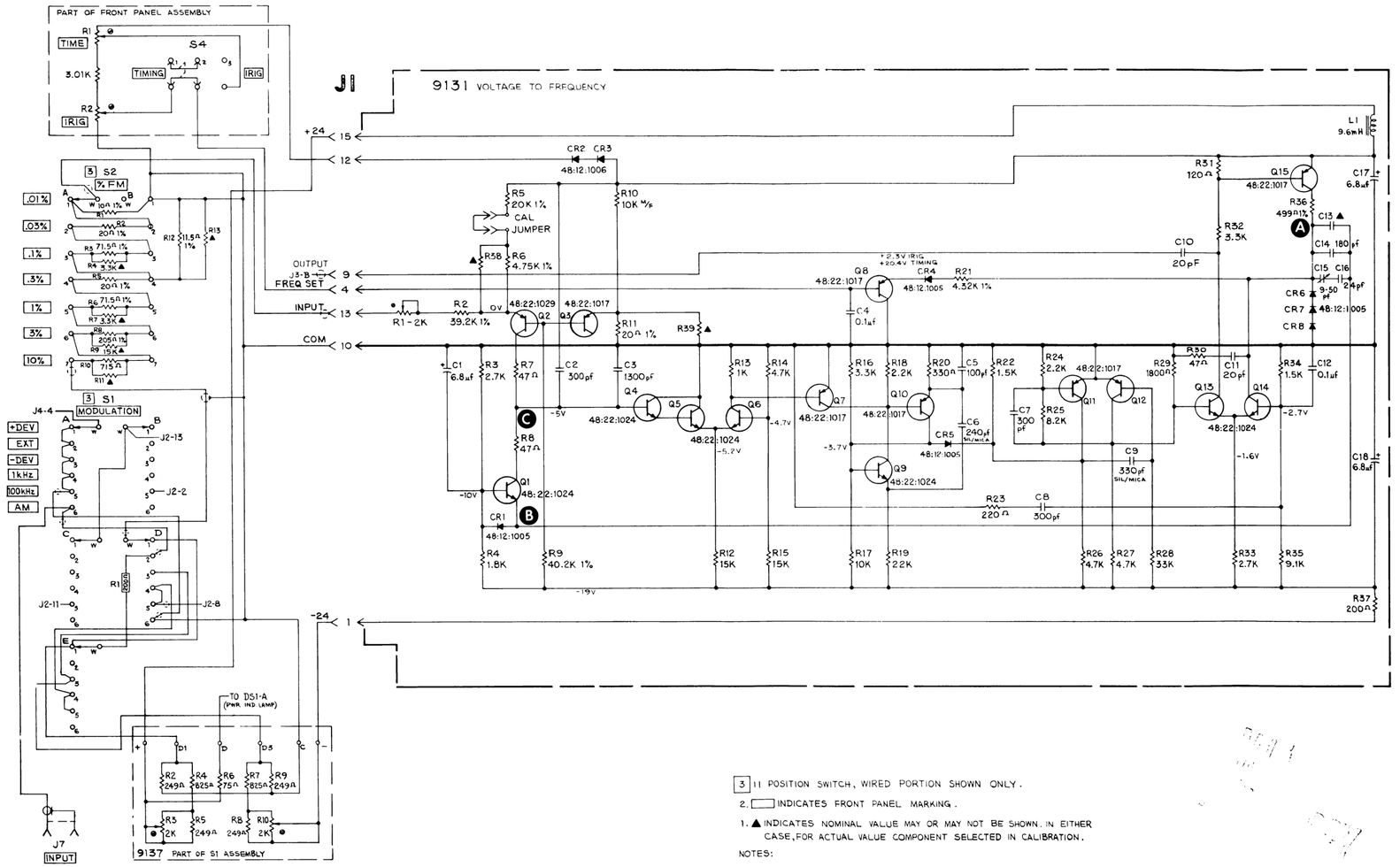
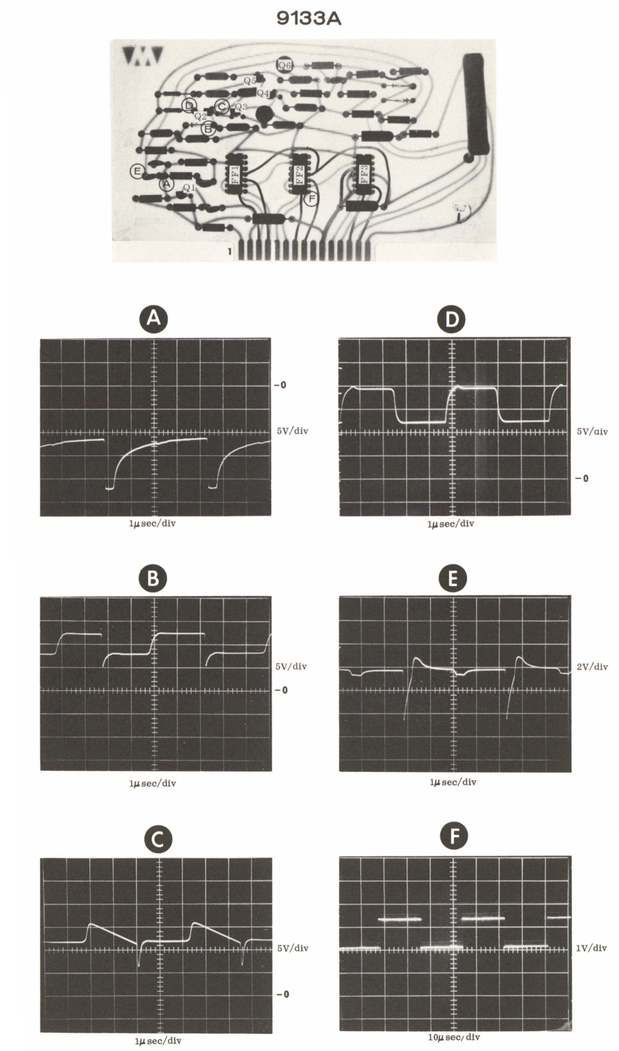
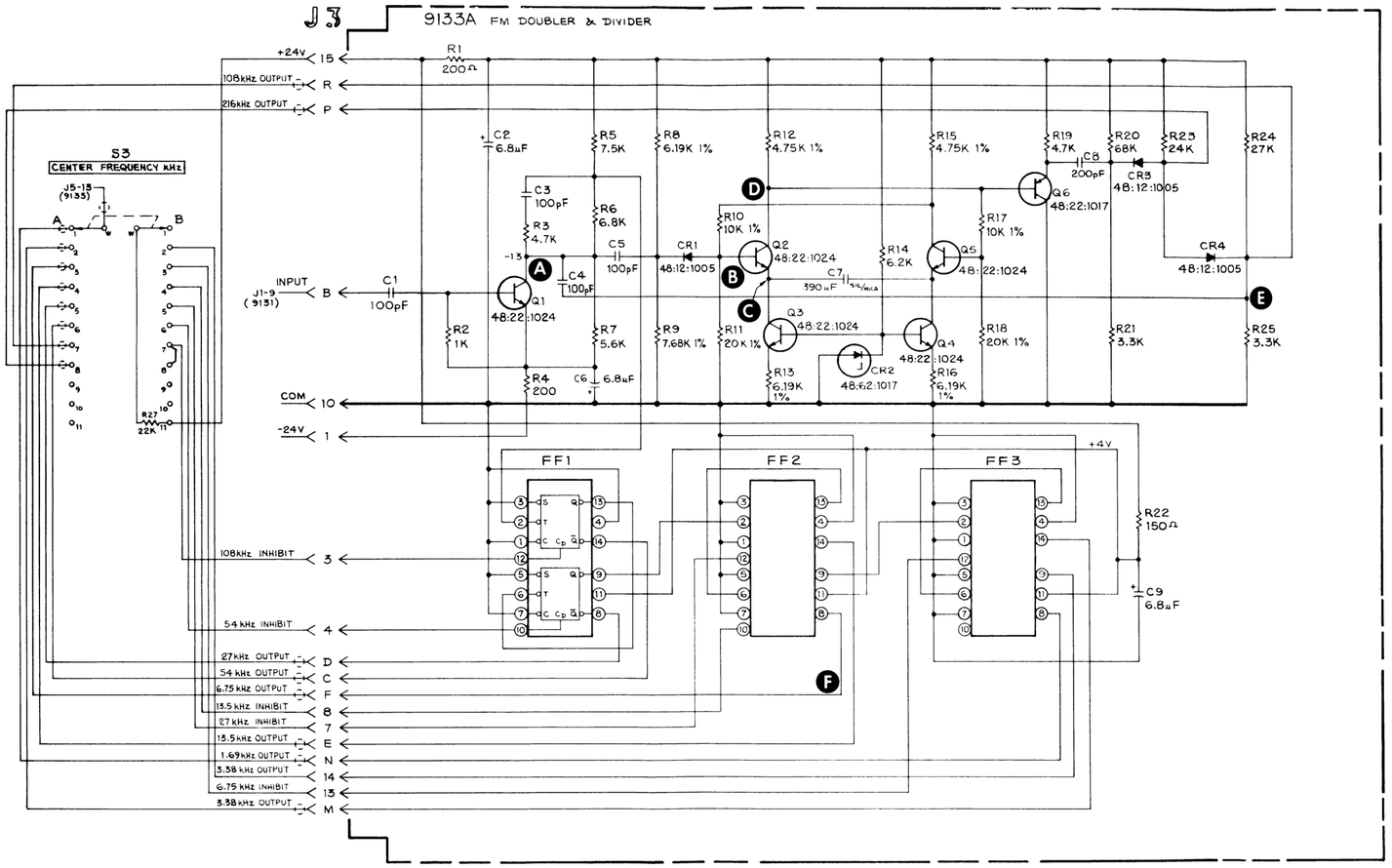


FIGURE 6-2

VOLTAGE TO FREQUENCY CONVERTER

(Card 9131)





1. ▭ INDICATES FRONT PANEL MARKING.

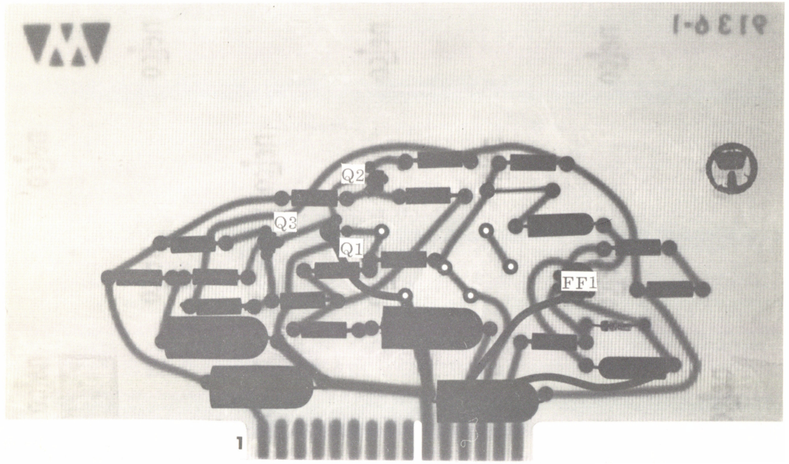
NOTES:

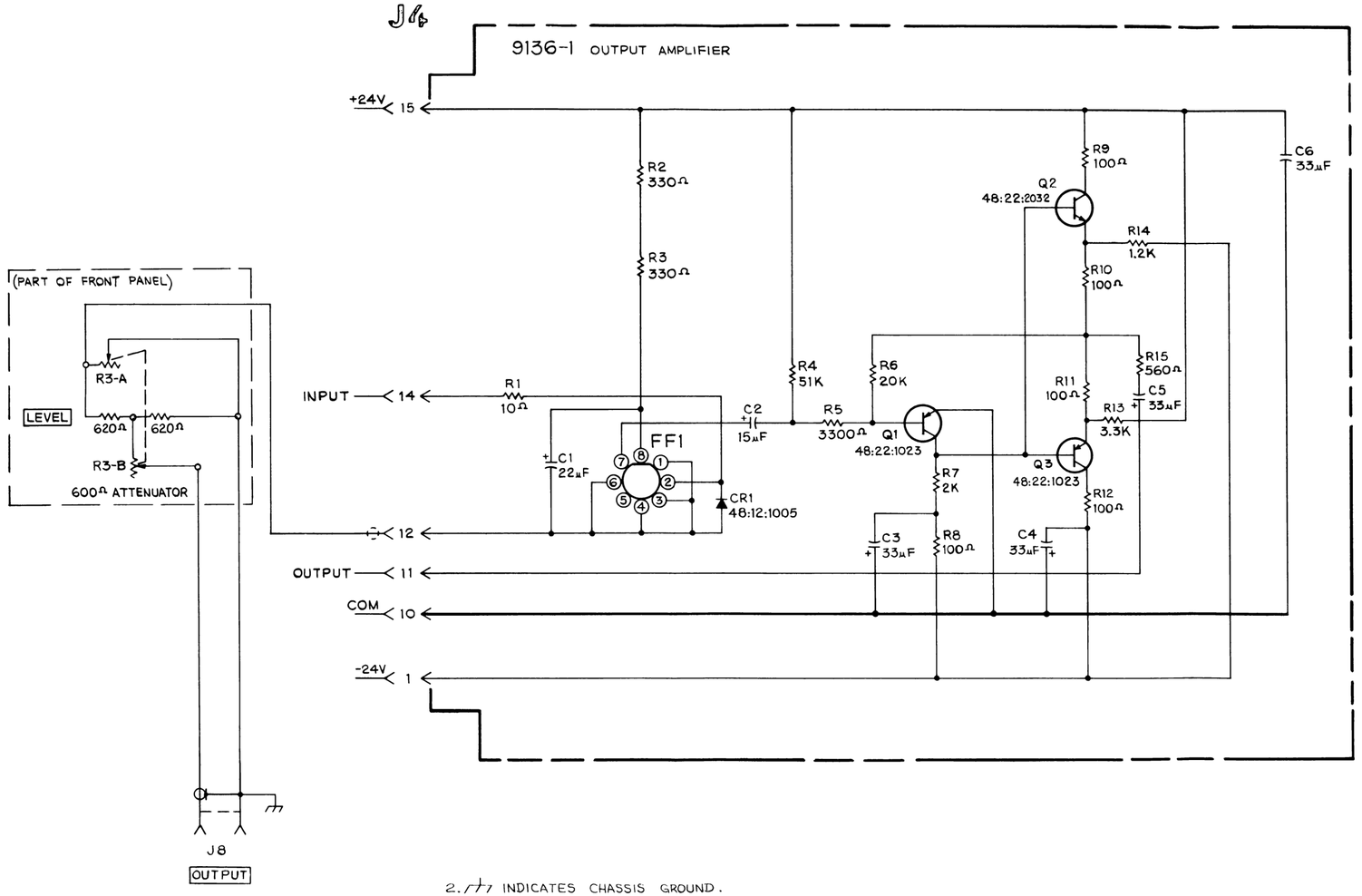
FIGURE 6-3

DOUBLER-DIVIDER CHAIN

(Card 9133A)

9136-1





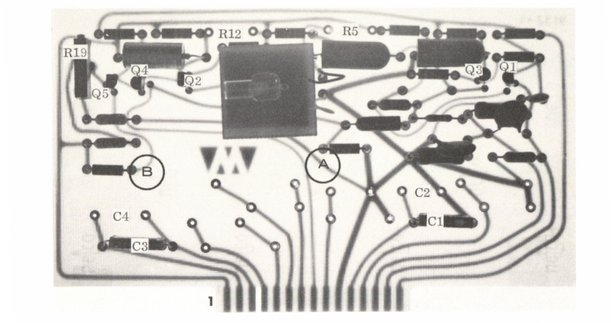
NOTES:

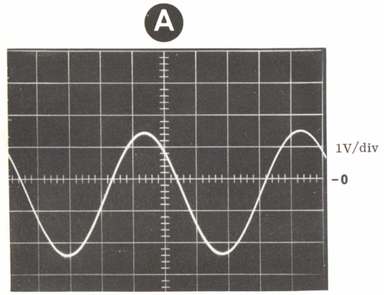
1. [ ] INDICATES FRONT PANEL MARKING.

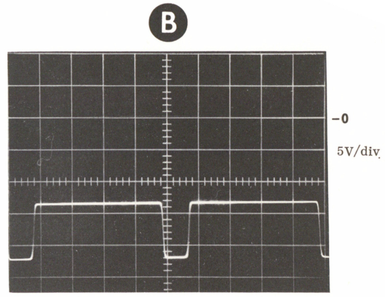
2. ⏚ INDICATES CHASSIS GROUND.

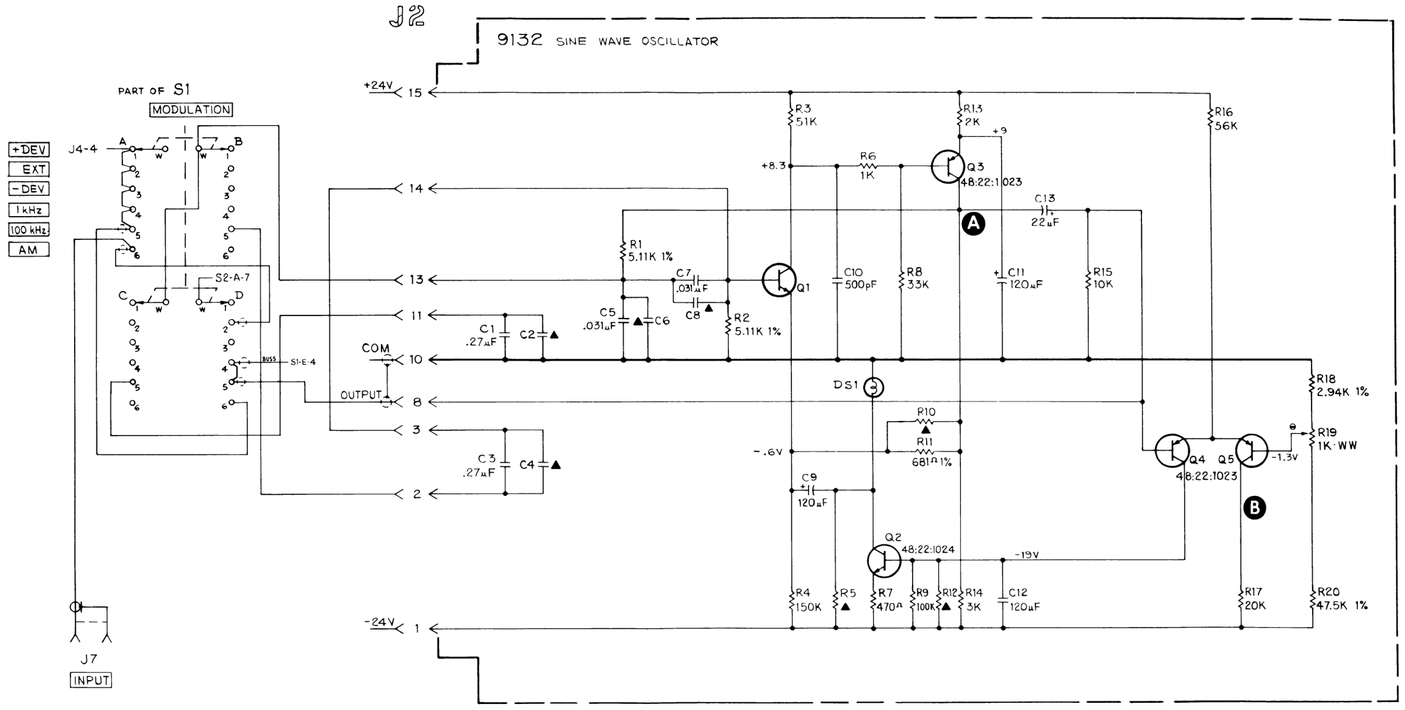
FIGURE 6-4
9100 OUTPUT AMPLIFIER
(Card 9136-1)

9132-1









2. [ ] INDICATES FRONT PANEL MARKING.

1. ▲ INDICATES COMPONENT SELECTED IN CALIBRATION.

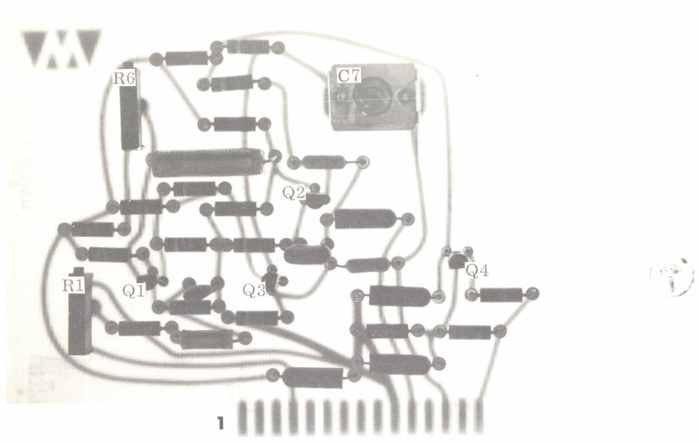
NOTES:

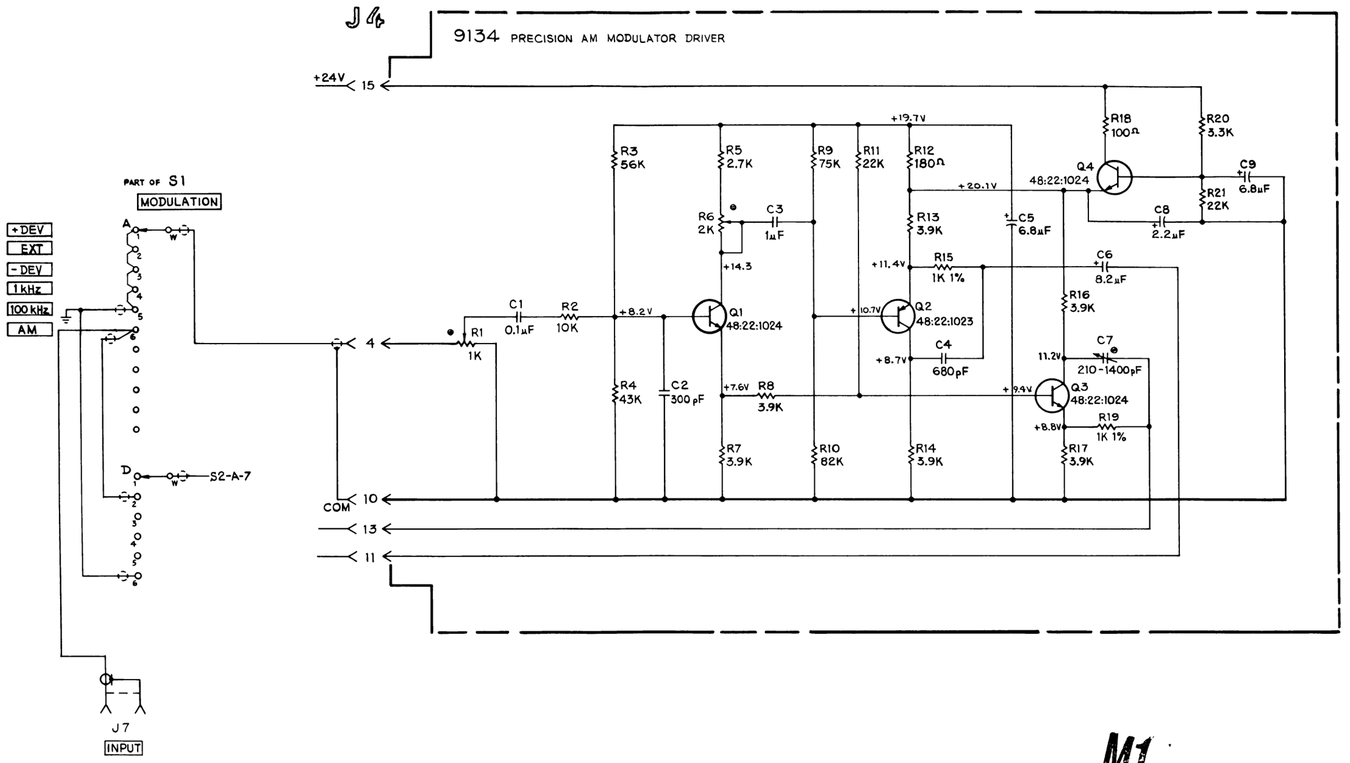
FIGURE 6-5

SINE WAVE OSCILLATOR

(Card 9132)

9134





NOTES:

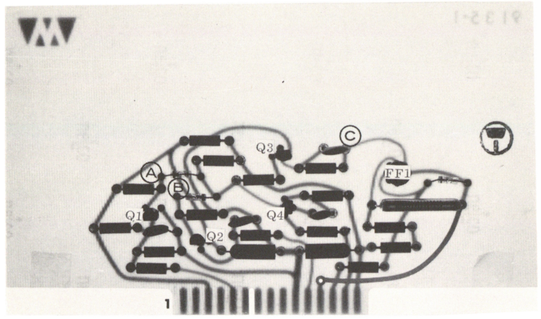
1. ▭ INDICATES FRONT PANEL MARKING.

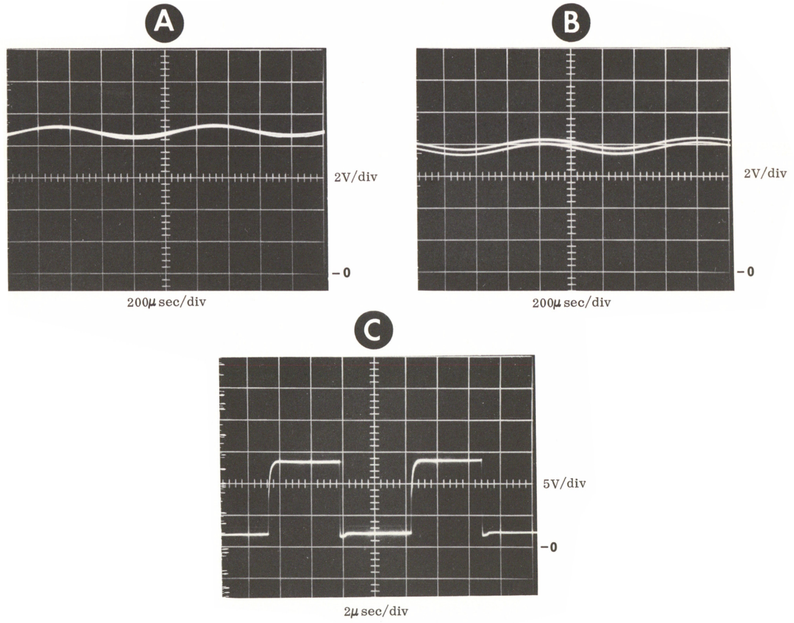
FIGURE 6-6

AM MODULATOR DRIVER

(Card 9134)

9135-1





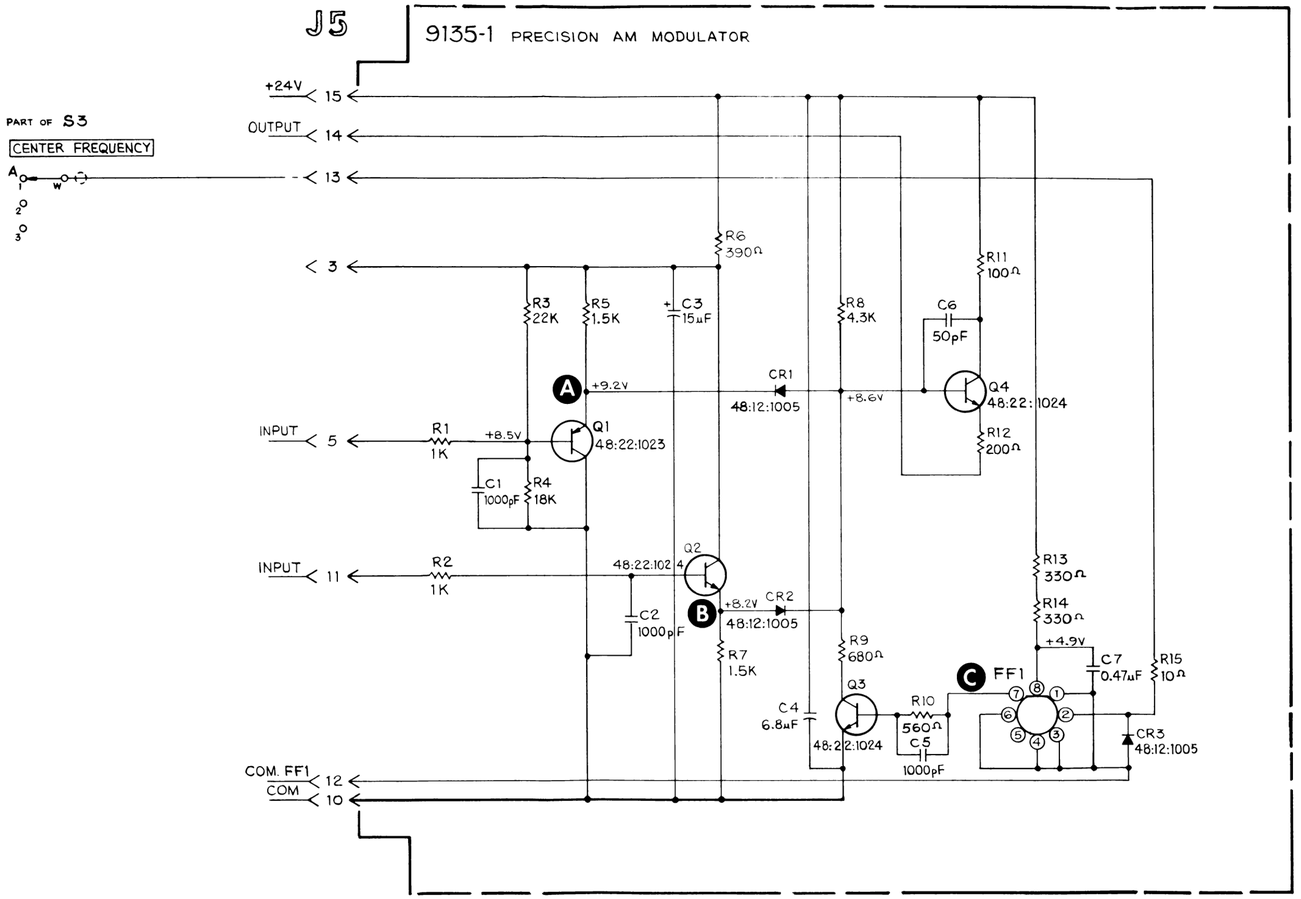
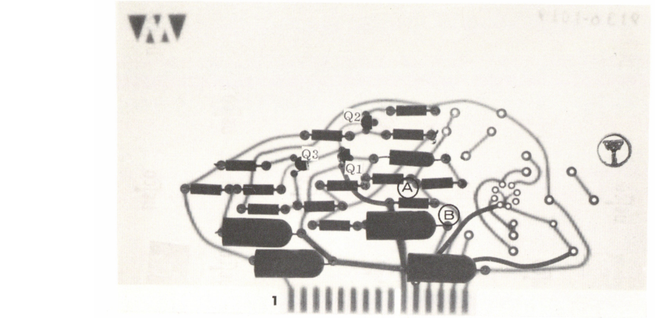
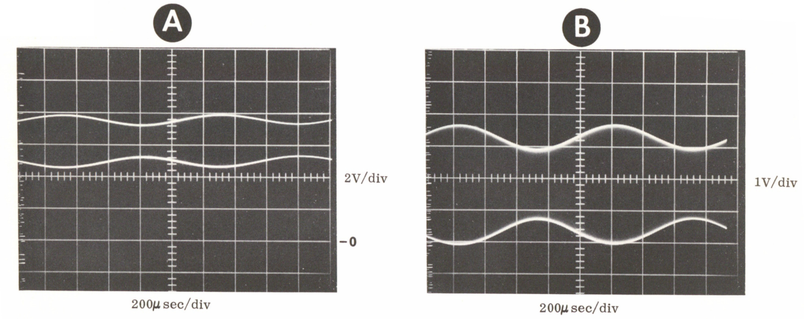
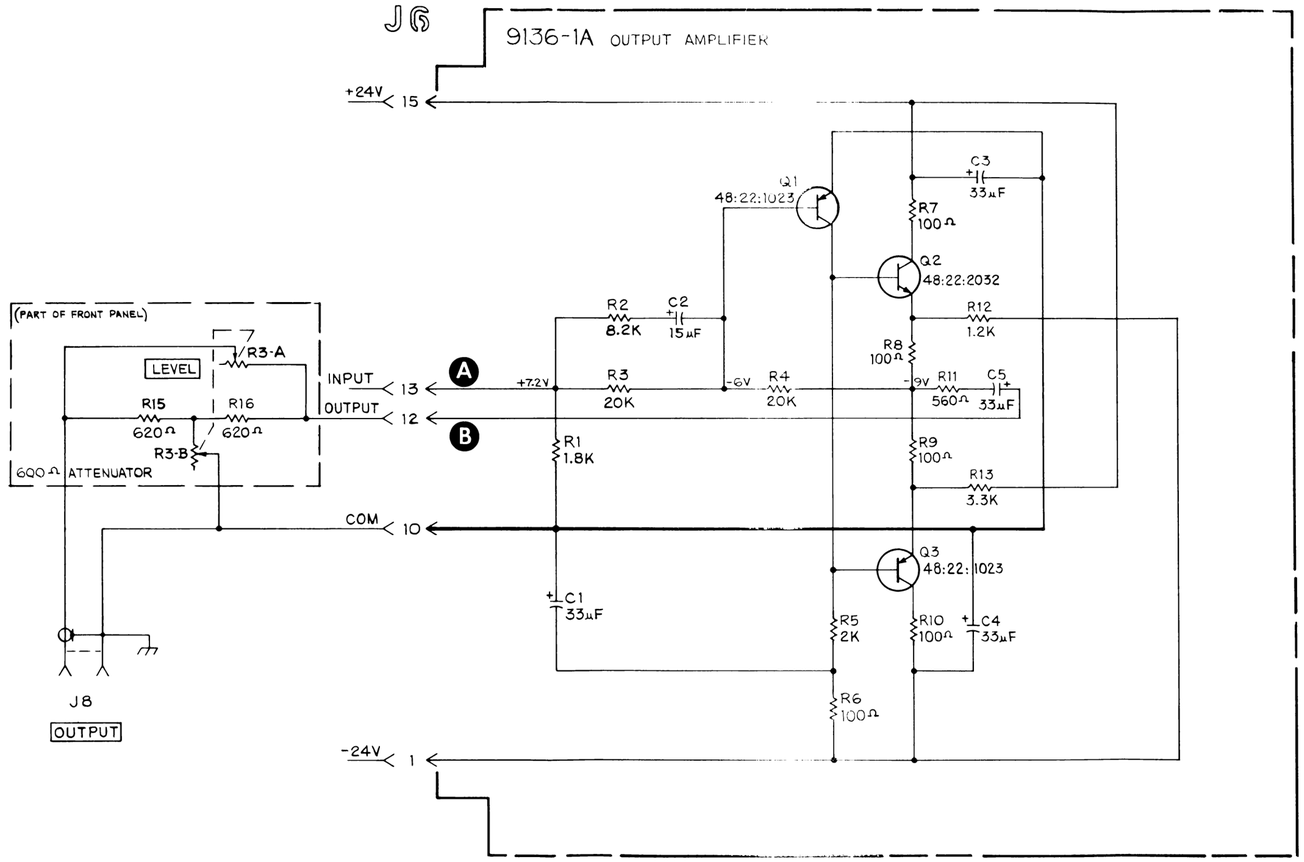


FIGURE 6-7
AM MODULATOR
(Card 9135-1)

9136-1A







2. ⏚ INDICATES CHASSIS GROUND.

1. [ ] INDICATES FRONT PANEL MARKING

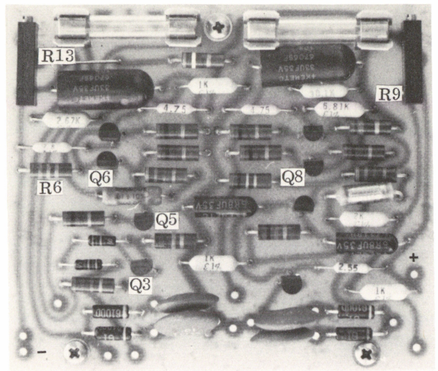
NOTES:

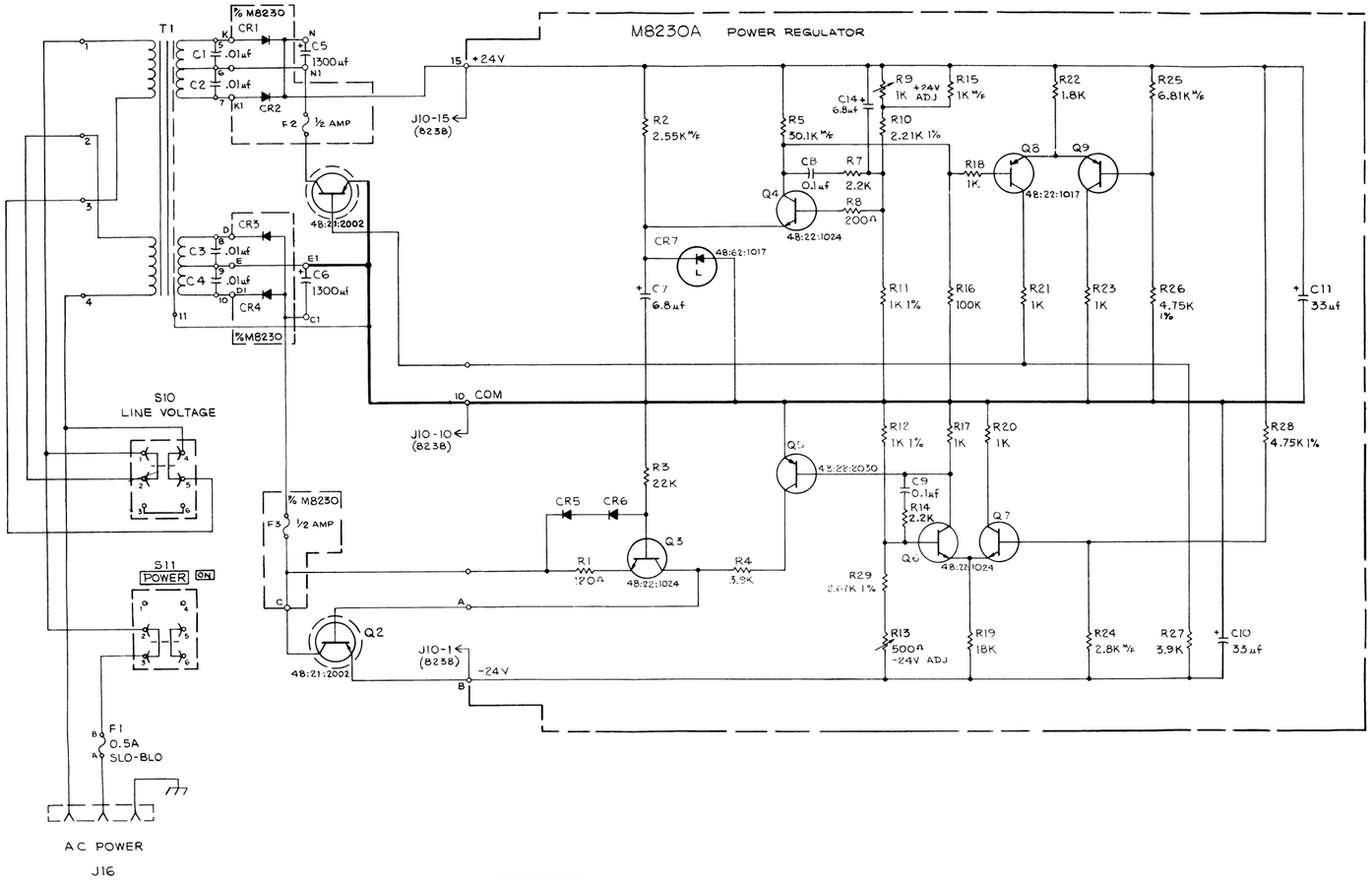
FIGURE 6-8

9100A OUTPUT AMPLIFIER

(Card 9136-1A)

8230A





4. ☐ INDICATES FRONT PANEL MARKING.
3. SWITCHES SHOWN IN NORMAL OPERATING POSITION.
2. BROKEN LINE ENCLOSING TRANSISTOR INDICATES COMPONENT MOUNTED ON HEAT SINK.
1. ▲ INDICATES COMPONENT SELECTED IN CALIBRATION.

NOTES:

FIGURE 6-9

REGULATED POWER SUPPLY
(Card 8230 A)

SECTION VII

TABLE OF REPLACEABLE PARTS

7-1 This section contains information for ordering replacement parts.

7-2 To obtain replacement parts, address your order to:

MICOM, Incorporated
855 Commercial Street
Palo Alto, California 94303

7-3 Specify the following information for each part ordered:

a. Model and complete serial number of the instrument
b. MICOM stock number
c. Circuit reference designator and description

For non-listed parts, include the model and serial numbers, a description of the part, and the function and location of the part.

REFERENCE DESIGNATORS

A	assembly	J	jack	R	resistor
C	capacitor	K	relay	S	switch
CR	diode	L	inductor	T	transformer
DS	lamp	M	meter	V	vacuum tube, photocell, etc.
F	fuse	MP	mechanical part	W	cable
FF	flip-flop	P	plug	Y	crystal
FL	filter	Q	transistor	Z	network

ABBREVIATIONS

A	Ampere	d	10^{-1}	Ge	germanium
dB	deciBel	m	10^{-3}	int cir	integrated circuit
F	Farad	μ	10^{-6}	met flm	metal film
H	Henry	n	10^{-9}	my	mylar
Hz	Hertz (cycle per second)	p	10^{-12}	poly	polystyrene
V	Volt			poly c	polycarbonate
W	Watt	al elect	aluminum electrolytic	Si	silicon
		cer	ceramic	sil mica	silver mica
M	10^{6}	comp	composition	Ta	tantalum
K	10^{3}	FET	field effect transistor	var	variable
D	10	fxd	fixed	ww	wirewound

▲ designates component selected in mfg. - may be omitted.

COMPANY ABBREVIATIONS

A	Arco	EM	Electromotive Mfg. Company	S	Sprague
AB	Allen Bradley	F	Fairchild	SC	Switchcraft
ANL	Amphenol	GE	General Electric	SH	Siemens and Halske
B	Bourns	GI	General Instrument	SY	Sylvania
CL	Clarostat	IRC	Internat'l. Resistance Co.	TI	Texas Instruments
CRL	Centralab	KT	Kemet	TRW	Thompson Ramo Woolridge
D	Dialco	MO	Motorola	VK	Viking
EL	Electra Mfg. Company	RA	Raytheon		

TABLE 7-1 REPLACEABLE PARTS

SCHEMATIC REFERENCE	DESCRIPTION OR COMMERCIAL EQUIVALENT	MICOM STOCK NO.	TQ
Card 9131 VOLTAGE TO FREQUENCY CONVERTER			
C1, C17, C18	C: fxd: Ta 6.8μF 20%, 35V	15:37:6857	3
C2, C7, C8	C: fxd: Cer 300pF 10%	15:19:3016	3
C3	C: fxd: Cer 1300pF 10%	15:19:1326	1
C4, C12	C: fxd: My 0.1μF 10%	15:29:1046	2
C5	C: fxd: Cer 100pF 10%	15:19:1016	1
C6	C: fxd: Sil Mica 240pF 5%	15:49:2415	1
C9	C: fxd: Sil Mica 330pF 5%	15:49:3315	1
C10, C11	C: fxd: Cer 20pF 10%	15:19:2006	2
C13	C: fxd: Sil Mica Selected in Assembly		1
C14	C: fxd: Sil Mica 180pF 5%	15:49:1815	1
C15	C: var: Cer 9-50pF	15:59:500Y	1
C16	C: fxd: Sil Mica 24pF 5%	15:49:2405	1
CR1, CR2, CR3, CR4, CR5, CR6, CR7, CR8	Diode: Si fast recovery GE 1N3064	48:22:1006	8
L1	L: fxd: 9.6mH 5%	18:23:9625	1
Q1, Q4, Q5, Q6, Q9, Q13, Q14	Transistor, Si NPN planar MO MPS2925	48:22:1024	7
Q2	Transistor, Si PNP planar MO MPS6523	48:22:1029	1
Q3, Q7, Q8, Q10, Q11, Q12, Q15	Transistor, Si PNP planar F 2N3638	48:22:1017	7
R1	R: var: WW2K, 20-turn screwdriver	47:53:2026	1
R2	R: fxd: Met Flm 39.2K 1% 1/4W	47:12:3922	1
R3, R33	R: fxd: Comp 2.7K 5% 1/2W	47:22:2725	2
R4, R29	R: fxd: Comp 1.8K 5% 1/2W	47:22:1825	2
R5	R: fxd: Met Flm 20K 1% 1/4W	47:12:2002	1
R6	R: fxd: Met Flm 4.75K 1% 1/4W	47:12:4751	1
R7, R8, R30	R: fxd: Comp 47 ohm 5% 1/2W	47:22:4735	3
R9	R: fxd: Met Flm 40.2K 1% 1/4W	47:12:4022	1
R10	R: fxd: Met Flm 10K 1% 1/4W	47:12:1002	1
R11	R: fxd: Met Flm 20 ohm 1% 1/4W	47:12:2002	1
R12, R15	R: fxd: Comp 15K 5% 1/2W	47:22:1535	2
R13	R: fxd: Comp 1.0K 5% 1/2W	47:22:1025	1
R14, R26, R27	R: fxd: Comp 4.7K 5% 1/2W	47:22:4725	3
R16, R32	R: fxd: Comp 3.3K 5% 1/2W	47:22:3325	2
R17	R: fxd: Comp 10K 5% 1/2W	47:22:1035	1
R18, R24	R: fxd: Comp 2.2K 5% 1/2W	47:22:2225	2
R19	R: fxd: Comp 22K 5% 1/2W	47:22:2235	1
R20	R: fxd: Comp 330 ohm 5% 1/2W	47:22:3315	1
R21	R: fxd: Met Flm 4.32K 1% 1/4W	47:12:4321	1
R22, R34	R: fxd: Comp 1.5K 5% 1/2W	47:22:1525	2
R23	R: fxd: Comp 220 ohm 5% 1/2W	47:22:2215	1
R25	R: fxd: Comp 8.2K 5% 1/2W	47:22:8225	1
R28	R: fxd: Comp 33K 5% 1/2W	47:22:3335	1
R34	R: fxd: Comp 120 ohm 5% 1/2W	47:22:1215	1
R35	R: fxd: Comp 9.1K 5% 1/2W	47:22:9125	1
R36	R: fxd: Met Flm 499 ohm 1% 1/4W	47:12:4990	1
R37	R: fxd: Comp 200 ohm 5% 1/2W	47:22:2015	1
Card 9132 SINE WAVE OSCILLATOR			
C1, C3	C: fxd: My 0.27μF Selected	15:29:2741	2
C2, C4, C6, C8	C: fxd: Selected in Production		4
C5, C7	C: fxd: My 0.031μF Selected	15:29:3131	2
C9, C11, C12	C: fxd: Ta 120μF 10V	15:32:1277	3
C10	C: fxd: Cer 500pF 10%	15:19:5016	1
C13	C: fxd: Ta 22μF 35V 20%	15:37:2267	1

TABLE 7-1 REPLACEABLE PARTS

SCHEMATIC REFERENCE	DESCRIPTION OR COMMERCIAL EQUIVALENT	MICOM STOCK NO.	TQ
DSI	Lamp, 15V 10mA UB 10CS/B1031	39:4x:1015	1
Q1, Q2	Transistor, Si NPN planar MO MPS2925	48:22:1024	2
Q3, Q4, Q5	Transistor, Si PNP planar F 2N3638	48:22:1017	3
R1, R2	R: fxd: Met Flm 5.11K 1% 1/4W	47:12:5112	2
R3	R: fxd: Comp 51K 5%	47:22:5135	1
R4	R: fxd: Comp 150K 5%	47:22:1545	1
R5, R10, R12	R: fxd: Selected in Production		3
R6	R: fxd: Comp 1.0K 5%	47:22:1025	1
R7	R: fxd: Comp 470 ohm 5%	47:22:4715	1
R8	R: fxd: Comp 33K 5%	47:22:3335	1
R9	R: fxd: Comp 100K 5%	47:22:1045	1
R11	R: fxd: Met Flm 681 ohm 1%	47:12:6810	1
R13	R: fxd: Comp 2.0K 5%	47:22:2025	1
R14	R: fxd: Comp 3.0K 5%	47:22:3025	1
R15	R: fxd: Comp 10K 5%	47:22:1035	1
R16	R: fxd: Comp 56K 5%	47:22:5635	1
R17	R: fxd: Comp 20K 5%	47:22:2035	1
R19	R: fxd: Met Flm 2.94K 1%	47:12:2941	1
R20	R: var: WW 1.0K 20-turn screwdriver	47:52:1026	1
R21	R: fxd: Met Flm 47.5K 1%	47:12:4752	1
Card 9133 LOCKED OSCILLATOR AND DIVIDER			
C1	C: fxd: Cer 50pF 10%	15:19:5006	1
C2, C6, C9	C: fxd: Ta 6.8μF 20% 35V	15:37:6857	3
C3, C4, C5	C: fxd: Cer 100pF 10%	15:19:1006	3
C7	C: fxd: Sil Mica 390pF 5%	15:49:3915	1
C8	C: fxd: Cer 200pF 10%	15:19:2016	1
CR1, CR3, CR4	Diode: Si fast recovery GE 1N3064	48:12:1005	3
CR2	Diode: Si breakdown 6.5V ±10%	48:62:1017	1
FF1, FF2, FF3, FF4	Integrated circuit dual JK flip-flop MO MC790P	48:52:1016	4
Q1, Q2, Q3, Q5, Q7	Transistor, Si NPN planar MO MPS2925	48:22:1024	5
Q6	Transistor, Si NPN planar F 2N3638	48:22:1017	1
R1, R4	R: fxd: Comp 200 ohm 5% 1/2W	47:22:2015	2
R2	R: fxd: Comp 1.0K 5% 1/2W	47:22:1025	1
R3, R19	R: fxd: Comp 4.7K 5% 1/2W	47:22:4725	2
R5	R: fxd: Comp 7.5K 5% 1/2W	47:22:7525	1
R6	R: fxd: Comp 6.8K 5% 1/2W	47:22:6825	1
R7	R: fxd: Comp 5.6K 5% 1/2W	47:22:5625	1
R8	R: fxd: Met Flm 6.19K 1% 1/4W	47:12:6191	1
R9	R: fxd: Met Flm 7.68K 1% 1/4W	47:12:7681	1
R10, R17	R: fxd: Met Flm 10K 1% 1/4W	47:12:1002	2
R11, R18	R: fxd: Met Flm 20K 1% 1/4W	47:12:2002	2
R12, R15	R: fxd: Met Flm 4.75K 1% 1/4W	47:12:4751	2
R13, R16	R: fxd: Met Flm 6.19K 1% 1/4W	47:12:6191	2
R14	R: fxd: Comp 6.2K 5% 1/2W	47:22:6225	1
R20	R: fxd: Comp 68K 5% 1/2W	47:22:6835	1
R21, R25	R: fxd: Comp 3.3K 5% 1/2W	47:22:3325	2
R22	R: fxd: WW 150 ohm 12W 20%	47:37:1517	1
R23	R: fxd: Comp 24K 5% 1/2W	47:22:2435	1
R24	R: fxd: Comp 27K 5% 1/2W	47:22:2735	1

TABLE 7-1 REPLACEABLE PARTS

SCHEMATIC REFERENCE	DESCRIPTION OR COMMERCIAL EQUIVALENT	MICOM STOCK NO.	TQ
Card 9134 AM MODULATOR DRIVER (9100A ONLY)			
C1	C: fxd: My 0.1μF 20%	15:29:1047	1
C2	C: fxd: Cer 300pF 10%	15:19:3016	1
C3	C: fxd: My 1μF 20%	15:29:1057	1
C4	C: fxd: Sil Mica 680pF 5%	15:49:6815	1
C5, C9	C: fxd: Ta 6.8μF 35V 20%	15:37:6857	2
C6	C: fxd: Ta 8.2μF 20V 20%	15:35:8257	1
C7	C: var: Mica Compression 210-1400pF	15:69:142W	1
C8	C: fxd: Ta 2.2μF 35V 20%	15:37:2257	1
Q1, Q3, Q4	Transistor, Si NPN planar MO MPS2925	48:22:1024	3
Q2	Transistor, Si PNP planar MO MPS 6519	48:22:1023	1
R1	R: var: WW 1.0K 10% 1W	47:53:1026	1
R2	R: fxd: Comp 10K 5% 1/2W	47:22:1035	1
R3	R: fxd: Comp 56K 5% 1/2W	47:22:5635	1
R4	R: fxd: Comp 43K 5% 1/2W	47:22:4335	1
R5	R: fxd: Comp 2.7K 5% 1/2W	47:22:2725	1
R6	R: var: WW 2.0K 10% 1W	47:53:2026	1
R7, R8, R13, R14, R16, R17	R: fxd: Comp 3.9K 5% 1/2W	47:22:3925	6
R9	R: fxd: Comp 75K 5% 1/2W	47:22:7535	1
R10	R: fxd: Comp 82K 5% 1/2W	47:22:8235	1
R11, R21	R: fxd: Comp 22K 5% 1/2W	47:22:2235	2
R12	R: fxd: Comp 180 ohm 5% 1/2W	47:22:1815	1
R15, R19	R: fxd: Met Flm 1.0K 1% 1/4W	47:11:1001	2
R18	R: fxd: Comp 100 ohm 5% 1/2W	47:22:1015	1
R20	R: fxd: Comp 3.3K 5% 1/2W	47:22:3325	1
Card 9135-1 AM MODULATOR (9100A ONLY)			
C1, C2, C5	C: fxd: My 1000pF 20%	15:29:1027	3
C3	C: fxd: Ta 15μF 20%	15:35:1567	1
C4	C: fxd: Ta 6.8μF 35V 20%	15:37:6857	1
C6	C: fxd: Cer 50pF 100V 10%	15:19:5006	1
C7	C: fxd: My 0.47μF 20%	15:29:4747	1
CR1, CR2, CR3	Diode: Si fast recovery GE 1N3064	48:12:1005	3
FF1	Integrated Circuit JK Flip-Flop F U8A992328	48:52:1028	1
Q1	Transistor, Si PNP planar MO MPS6519	48:22:1015	1
Q2, Q3, Q4	Transistor, Si NPN planar MO MPS2925	48:22:1024	3
R1, R2	R: fxd: Comp 1.0K 5% 1/2W	47:22:1025	2
R3	R: fxd: Comp 22K 5% 1/2W	47:22:2235	1
R4	R: fxd: Comp 18K 5% 1/2W	47:22:1835	1
R5, R7	R: fxd: Comp 1.5K 5% 1/2W	47:22:1525	2
R6	R: fxd: Comp 390 ohm 5% 1/2W	47:22:3915	1
R8	R: fxd: Comp 4.3K 5% 1/2W	47:22:4325	1
R9	R: fxd: Comp 680 ohm 5% 1/2W	47:22:6815	1
R10	R: fxd: Comp 560 ohm 5% 1/2W	47:22:5615	1
R11	R: fxd: Comp 100 ohm 5%	47:22:1015	1
R12	R: fxd: Comp 200 ohm 5%	47:22:2015	1
R13, R14	R: fxd: Comp 330 ohm 5%	47:22:3315	2
R15	R: fxd: Comp 10 ohm 5%	47:22:1005	1

TABLE 7-1 REPLACEABLE PARTS

SCHEMATIC REFERENCE	DESCRIPTION OR COMMERCIAL EQUIVALENT	MICOM STOCK NO.	TQ
Card 9136-1 OUTPUT AMPLIFIER (9100 ONLY)			
C1	C: fxd: Ta 22μF 15V 20%	15:33:2267	1
C2	C: fxd: Ta 15μF 20V 20%	15:35:1567	1
C3, C4, C5, C6	C: fxd: Ta 33μF 35V 20%	15:37:3367	4
CR1	Diode: Si fast recovery GE 1N3064	48:12:1005	1
FF1	Integrated circuit JK flip-flop F U8A99238	48:52:1028	1
Q1, Q3	Transistor, Si PNP planar MO MPS6519	48:22:1023	2
Q2	Transistor, Si NPN planar MO MPS6531	48:22:2032	1
R1	R: fxd: Comp 10 ohm 5% 1/2W	47:22:1005	1
R2, R3	R: fxd: Comp 330 ohm 5% 1/2W	47:22:3315	2
R4	R: fxd: Comp 51K 5% 1/2W	47:22:5135	1
R5, R13	R: fxd: Comp 3.3K 5% 1/2W	47:22:3325	2
R6	R: fxd: Comp 20K 5% 1/2W	47:22:2035	1
R7	R: fxd: Comp 2K 5% 1/2W	47:22:2025	1
R8, R9, R10, R11, R12	R: fxd: Comp 100 ohm 5% 1/2W	47:22:1015	5
R14	R: fxd: Comp 1.2K 5% 1/2W	47:22:1225	1
R15	R: fxd: Comp 560 ohm 5% 1/2W	47:22:5615	1
Card 9136-1A OUTPUT AMPLIFIER (9100A ONLY)			
C1, C3, C4, C5	C: fxd: Ta 33μF 35V 20%	15:37:3367	4
C2	C: fxd: Ta 15μF 20V 20%	15:35:1567	1
Q1, Q3	Transistor, Si PNP planar MO MPS6519	48:22:1023	2
Q2	Transistor, Si NPN planar MO MPS6531	48:22:2032	1
R1	R: fxd: Comp 1.8K 5% 1/2W	47:22:1825	1
R2	R: fxd: Comp 8.2K 5% 1/2W	47:22:8225	1
R3, R4	R: fxd: Comp 20K 5% 1/2W	47:22:2035	2
R5	R: fxd: Comp 2.0K 5% 1/2W	47:22:2025	1
R6, R7, R8, R9, R10	R: fxd: Comp 100 ohm 5% 1/2W	47:22:1015	5
R11	R: fxd: Comp 560 ohm 5% 1/2W	47:22:5615	1
R12	R: fxd: Comp 1.2K 5% 1/2W	47:22:1225	1
R13	R: fxd: Comp 3.3K 5% 1/2W	47:22:3325	1
Card 8230-1 REGULATED POWER SUPPLY			
C1, C2, C3, C4	C: fxd: Cer 0.01μF GMV	15:37:1039	4
C5, C6	C: fxd: Al Elect 1300μF 50V	15:78:1387	2
C7, C14	C: fxd: Ta 6.8μF 20% 35V	15:37:6857	2
C8, C9	C: fxd: Met My 0.1μF 10%	15:29:1046	2
C10, C11	C: fxd: Ta 33μF 20% 35V	15:37:3367	2
CR1, CR2, CR3, CR4	Diode: Si power 1N4383	48:12:2013	4
CR5, CR6	Diode: Si GP 1N458A	48:12:1006	2
CR7	Diode: Si breakdown 6.5V ±10%	48:62:1017	1
F1	Fuse: 1/2 ampere slow blow 3AG	51:12:0050	1
F2, F3	Fuse: 1/4 ampere reg., 3AG	51:11:0050	2
J6	Connector, AC 3 pin male power	21:14:0603	1
R1	R: fxd: Comp 150 ohm 5% 1/2W	47:22:1515	1
R2	R: fxd: Met Flm 2.55K 1% 1/4W	47:11:2551	1
R3	R: fxd: Comp 22K 5% 1/2W	47:22:2235	1
R4, R27	R: fxd: Comp 3.9K 5% 1/2W	47:22:3925	2
R5	R: fxd: Met Flm 30.1K 1% 1/4W	47:11:3012	1

TABLE 7-1 REPLACEABLE PARTS

SCHEMATIC REFERENCE	DESCRIPTION OR COMMERCIAL EQUIVALENT	MICOM STOCK NO.	TQ
R6	R: fxd: Selected		1
R7, R14	R: fxd: Comp 2.2K 5% 1/2W	47:22:2225	2
R8	R: fxd: Comp 200 ohm 5% 1/2W	47:22:2015	1
R9	R: var: WW 1K	47:53:1025	1
R10	R: fxd: Met Flm 2K 1% 1/4W	47:11:2001	1
R11, R12, R13	R: fxd: Met Flm 1K 1% 1/4W	47:11:1001	3
R13	R: var: WW 500 ohm	47:52:5016	1
R16	R: fxd: Comp 100K 5% 1/2W	47:22:1045	1
R17, R18, R20, R21, R23	R: fxd: Comp 1K 5% 1/2W	47:22:1025	5
R19	R: fxd: Comp 18K 5% 1/2W	47:22:1835	1
R22	R: fxd: Comp 1.8K 5% 1/2W	47:22:1825	1
R24	R: fxd: Met Flm 2.8K 1% 1/4W	47:11:2801	1
R25	R: fxd: Met Flm 6.81K 1% 1/4W	47:11:6811	1
R26, R28	R: fxd: Met Flm 4.75K 1% 1/4W	47:11:4751	2
R29	R: fxd: Met Flm 2.67K 1% 1/4W	47:11:2671	1
S10	Switch, slide 2P2T 115-230V	51:22:0201	1
S11	Switch, rocker 2P1T power switch	51:52:0202	1
T1	Transformer, power 115-230V pri.	56:11:1255	1
	Fuse clips	21:26:2300	4
	Fuse holder 3AG 1/4 x 1-1/4"	21:27:1700	1
FRONT PANEL			
S1	Assembly, MODULATION switch 4 sect 5 pos includes Bd 9137		
S1A	Assembly, MODULATION switch 5 sect 6 pos includes Bd 9137		
S2	Assembly, % FM switch 2 sect 7 pos includes R1-R13		
S3	Assembly, CENTER FREQUENCY 2 sect 8 pos includes R1		
S4	Switch, slide 2P2T	51:12:0204	1
S5	Switch, rocker 2P1T POWER switch	51:52:0202	1
DS1	Lamp, 28V 40mA bipin amber	39:13:2840	1
J1, J2	Connector, BNC UG657/U	21:25:0700	2
R1, R2	Resistor, var WW 100 4W S. taper	47:55:102C	2
R3AB	Assembly, LEVEL 100K, 25K, 620 ohm	47:20:601 sp.	1
R4	Resistor, fixed met flm 3.01K 1% 1/4W	47:12:3011	1
CHASSIS COMPONENTS			
	Clip: #6-32 screw Timnerman C6452-632	28:72:7602	16
	Clip: #4-40 screw Timnerman C7795-44027	28:72:7601	20
	Clip: Timnerman bipin lamp holder	21:29:1100	1
	Side casting, standard	14:60:0003	2
	Knob, switch, bar RA D570B-1-2G	24:22:0005	3
	Knob, switch, round RA DS70-1BD-2G	24:22:0006	1
	Feet, rubber	28:87:0001	4
	Cover, standard	14:11:0002	2
	Screws, phillips flat-head, 6-32 x 1/2", SS	28:11:2606	12
	Screws, rack mounting 10-32 x 2" phillips, fillister head	28:11:2118	4
	Screws, side casting mounting, #8 x 1-1/4" sheet metal phillips, oval head	28:12:4814	2
	Socket, bipin lamp	21:26:1000	1
	Power Cord, type SVT8 #18-3, Belden #17258-S	60:5x:0002	1
	Connector 15 pin p.c. single sided	21:21:0815	
	Connector 15 pin p.c. double sided	21:21:0915	